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HISTORY OF CANADIAN SURGERY

JOHN STEWART*

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It is now more than a quarter of a century since Dr. John Stewart died, yet his memory has remained as an inspiration to those who knew him, and his tradition has lived on in his native province and in the medical school to which he gave such exemplary service.

Dr. Stewart was born on July 3, 1847, at St. George's Channel, Richmond County, Nova Scotia, where his father, the Reverend Murdoch Stewart, was the Presbyterian minister. He attended the Model School in Truro, Nova Scotia, and later the Provincial Normal College in the same town. After graduation he taught for one year in Sydney Academy, and then resolved to study medicine. He entered Dalhousie College for this purpose but because the future of medical education there was at that time uncertain, he transferred to Edinburgh. He graduated M.B., C.M., on October 6, 1877, at the age of 30.

Immediately before Stewart's graduation, Professor Joseph Lister had been invited to accept the Chair of Clinical Surgery at King's College Hospital, London. The story of events which preceded and followed this is part of well recorded medical history. Suffice it to say that Lister chose John Stewart as one of his house surgeons, familiar with his technique of antiseptic surgery, to go to London with him. In later years he used to recall vividly how he rode to Lister's first lecture in a cab, carrying with great care the culture tubes demonstrating the presence of living organisms. It was a day of days, and one on which the sun rose to give new light and hope to a suffering world.

If Stewart thought about his future at all at that time it would have seemed bright to any ambitious young man. True, Lister was not accepted in London with open arms or with immediate acknowledgment of the greatness of his discovery, but he had supreme faith in its value, a faith amply justified by its use. He was a son of a wealthy family; he could afford to wait a while. In the meantime, his house surgeons knew that they were standing with him on the brink of an epoch. All that was necessary was to work well and wait. Stewart, a man over six feet tall, handsome, dignified and of gentle bearing, could look forward to a career full of honours and achievement. Within a year, if such a dream existed, it vanished, at least for the moment. His father had died and family needs required his presence in Nova Scotia as head of the family. If he had regrets nobody knew of them. He returned to Canada and began to practise in Pictou where his brother was a lawyer.

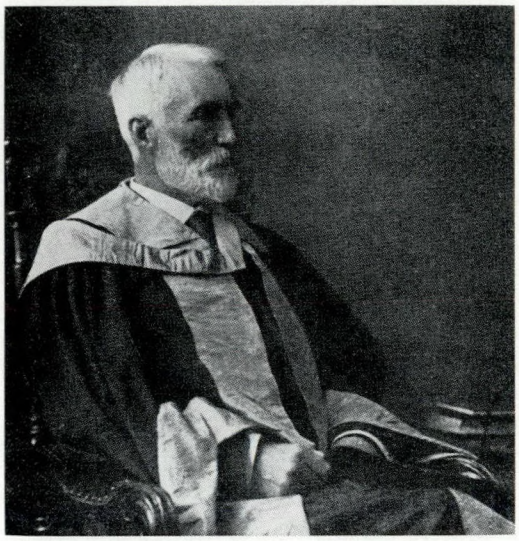

Fig. 1.—Dr. John Stewart

Those were days of a great educational awakening in Pictou. The college, founded there in 1816 by Thomas McCulloch, D.D., had vanished and left in its place a struggling Academy to recall its former glory, which now seemed in revival. George Munro, a native of Pictou County had made a fortune as a publisher in New York, and, not forgetting his old school, he created a number of scholarships and bursaries available to its graduates, which enabled many to secure a

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university education. Students came to it from afar, the quality of its teaching became unsurpassed in the Maritime Provinces at that time, and its fame returned. Dr. John Stewart was deeply interested in the school and its students. He was single, he lived near the Academy and rejoiced in associating with the students and members of its faculty. He was a naturalist and his love of the beautiful countryside around Pictou made it easy for him to steal away from a busy practice for long walks with a friend. In later years he was regarded with some wonder as a botanist and ornithologist. Dr. Stewart's extensive and accurate knowledge in both of these sciences was gained almost unconsciously in the pleasant school of friendly and cultured associations.

Meanwhile his brother's family was growing and as he was unmarried, Dr. Stewart gave them the affection his own children would have won. He was an inspiring uncle. Football and lacrosse were popular games in Pictou in those days, and in these he excelled. The Pictou County Artillery Company was organized and he became one of its officers. As a younger man he had held a commission in the Third Regiment of Richmond County. As a surgeon he was gaining a wide reputation.

When Dr. Stewart began his practice there was but one general hospital in Nova Scotia, the Provincial and City Hospital in Halifax, which was over 100 miles from Pictou by road or rail, and much farther by water. As a result, and in keeping with good practice of that day, operations were done at home. If antiseptic surgery seems archaic in our day, it must be admitted that it lent itself admirably to the kitchen table era. Provided the surgeon had instruments and linen, the average household supplied all other needs but a few ounces of chloroform and a bottle of carbolic acid crystals. Stewart had taken a Lister spray from London and it is now at Dalhousie University. That took care of the operation field. Instruments were immersed in 1:20 carbolic acid. Hands were scrubbed and immersed from time to time in the same solution. Linen, sponges and sutures all went through the same process. Any inadequacies were taken care of by the acquired resistance of members of the household to their native bacteria. Chloroform, properly given, was a safe anesthetic. Dr. Stewart had been brought up in a school where speed and dexterity were highly valued. He made full use of these, but as he gained confidence in his developed methods he exhibited a wonderful degree of care and thoroughness. Fifty years after John Stewart began to practise in Pictou, I made the same attempt in the same town. There were men and women living to exhibit the honourable scars received at his hands and to attest to the greatness of his skill. At the same time there were physicians in practice who had worked with him during what we would now consider the pioneer days. One of these told me of a young man who had developed a tuberculous lesion of the hip joint with abscess formation. The narrator was asked by Dr. John Stewart to give the anesthetic. The room was prepared, the kitchen table draped and everything was in readiness. Before the anesthetic was begun, the surgeon gathered the family together in the kitchen and in a simple unaffected way told them what he was going to attempt and ended by asking God's help in the task before him. "Then", continued my informant, "we went into the improvised operating room. Dr. Stewart cut down on the head of the femur and curetted away the last bit of necrotic bone. He swabbed out the abscess track with a sponge which had been wrung out of carbolic acid solution; then he closed the incision without drainage, all of which took about two hours. The wound healed by first intention." I asked, "What became of the patient?" He replied, "You see that man plowing over on that hill; he is the man." Forty years had passed!

It was during the Pictou years that Stewart was an unwilling participant in an episode that caused him much discontent and uneasiness. In 1885, owing to a dispute over an appointment at the Provincial and City Hospital in Halifax, the entire visiting staff resigned. As it was the only teaching hospital then available, the Halifax Medical College decided to

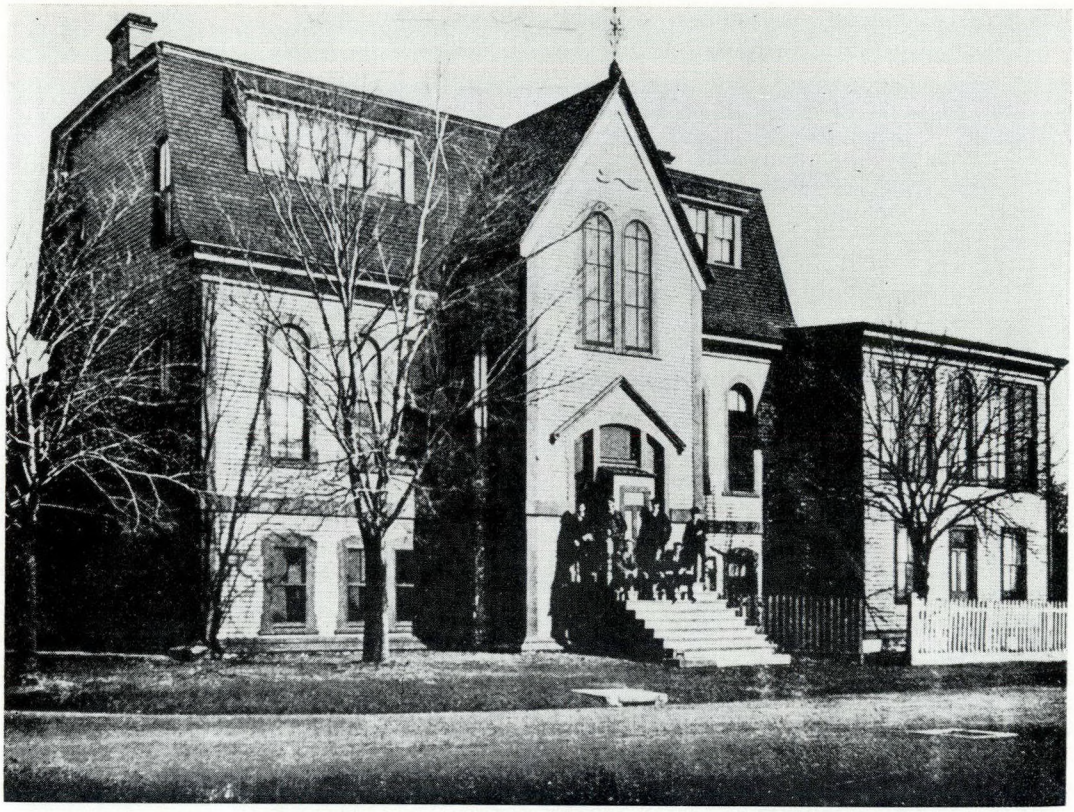

Fig. 2.—The original Halifax Medical College

suspend operations as well. The entire matter was fully investigated and administrative matters at the Hospital were the subject of severe public criticism. Since Dr. Stewart had a comprehensive knowledge of hospitals in both London and Edinburgh, as well as of some on the Continent, his opinion was sought and given. It was a time when feelings ran high, and no opinion was likely to meet with universal favour. In any event, his was a fair and honest appraisal of the situation as he saw it. Eventually a solution was reached which removed the hospital from joint ownership by the City of Halifax and the Province of Nova Scotia, and conferred its sole ownership upon the Province. The bed capacity was increased by 100, and the institution was renamed the Victoria General Hospital in 1887, Queen Victoria's jubilee year.

In the same year the Sisters of Charity, at the suggestion of Dr. Stewart, opened a small hospital on Barrington Street in Halifax which they named The Victoria Infirmary. It was the beginning of the present Halifax Infirmary.

By 1894, Dr. Stewart decided that there were no immediate prospects for the erection of a hospital in Pictou County, and that he could pursue a career of greater usefulness in the province's capital city. He was at once appointed to the Faculty of Medicine at Dalhousie University, but did not choose to become a member of the staff of the Victoria General Hospital. As long as he continued in active practice the greater part of his work was done at the Infirmary. By this time aseptic surgery was replacing antiseptic surgery. It was difficult for him to change from a method which he had seen at its birth and which he had used so successfully for many years of practice. There was also a feeling of transcendent devotion and loyalty to his old teacher Lord Lister, that made him loath to relinquish his methods. He changed slowly and reluctantly, and when called out of Halifax to operate, as occurred constantly, he

would revert to former techniques if the local circumstances permitted.

It is almost impossible today for a younger member of the medical profession to grasp the spirit which pervaded the practice of medicine and its evolving specialties in Nova Scotia from 1894 to 1914. Those who aspired to recognition in a special field had emerged, almost without exception, from a background of general practice. Sometimes the transfer to specialized practice was heralded by a period spent in one of the large centres in the United States, the British Isles or Germany; in other instances it would be founded upon local success and experience. In most instances the arrival of a new surgeon on the scene was not greeted with applause by his new associates. All were rugged individualists, accustomed to working alone. They were resourceful and aggressive. In Halifax, practice was highly competitive. The poor were treated, and well treated, free, and there were many poor. Consequently the paying patient was jealously watched. The "little books" on ethics were frequently consulted and unethical conduct was a common accusation levelled in official conclaves. Into this professional maelstrom came John Stewart. Where most others would have failed, he succeeded beyond the most sanguine hopes.

The reasons for this success were many. In the first place, his training and skill as a surgeon were first class. In the second place he had no desire to make money—a modest competence was all he asked. Finally, in every word and action, he was a man above the crowd. There was no malice in his being, and he was never known to speak unkindly of anyone. Though deeply religious, he did not force his opinions or beliefs on anybody but was a living example of the strength of his faith. Where his skill alone might have failed, his lack of self-seeking, and unassuming uprightness of character won. He remained stately and serene above his bickering associates who soon grew to trust and love him.

He was elected President of the Canadian Medical Association in 1905. In 1906 he was appointed to the Provincial Medical Board and later became its president. In 1913 he became Professor of Surgery at Dalhousie University.

Then, in 1914 came World War I. In 1915 the Dalhousie University Number 7 Stationary Hospital was organized for service overseas. In spite of his 67 years, John Stewart was placed in command by unanimous consent. The unit reached France early in 1916 and remained there until the end of the war. On July 3, 1917, the Hospital was at Arque, and on that day it was visited and inspected by King George V. His Majesty spent some hours there in conversation with the staff and Colonel Stewart, who afterwards said that it was only by a great effort of restraint that he refrained from telling the king that it was his seventieth birthday. In March 1918, he was transferred from his command to Canadian Army Medical Corps Headquarters in England as Consulting Surgeon.

On his return to Canada on January 6, 1919, Dr. Stewart was tendered a banquet of welcome by educational, business and professional men of Nova Scotia. On October 6, 1927, when he celebrated 50 years of practice he was again honoured at a banquet and presented with a purse of gold.

Fig. 3.—Lister spray which Dr. Stewart used in his operations.

Following his return from overseas Dr. Stewart began to retire gracefully. In 1919 he was made Dean of the Faculty of Medicine at Dalhousie University, and the cares of an expanding school occupied much of his time. However, he was Consulting Surgeon at Camp Hill Hospital, and would from time to time see old friends in consultation, but his active days of practice were over.

Honours began to almost crowd upon him. He had retired from active service in the Army with the rank of Colonel and was made a Commander of the British Empire. In connection with the Lister Celebration in 1927, the Royal College of Surgeons of Edinburgh bestowed on him their Honorary Fellowship, which is the highest award the College is able to bestow and which is awarded very sparingly. He was also given the honorary degrees of Doctor of Law by both Dalhousie and McGill Universities. He was twice President of the Medical Society of Nova Scotia; once, as previously noted, of the Canadian Medical Association, and once of the Medical Council of Canada. He delivered the first Listerian Oration to the Canadian Medical Association in 1924, which revealed his unexcelled mastery of the English language.

In the spring of 1932 Dr. Stewart led his last medical class to graduation. A few days before, he had heard them subscribe to the Hippocratic Oath. It was an event to remember, the tall bearded figure unbent by his 85 years, standing before them. It must have recalled to his mind a similar scene in his own day. He told them in simple language of their obligations to themselves and to society. He ventured the hope that they were going out with some inspiration, to live full and useful lives. Then in tones which at times were almost a whisper, so deep was his emotion, he recalled that day in London, 55 years before, "when I rode with my great master to his first lecture," and how supreme the influence of that acquaintance with Lister had reigned over his whole life thereafter. With this over he wished them well.

During the year that followed, his health slowly deteriorated and he went out very little. Gradually he became bedfast and died shortly before 9 p.m. on December 26, 1933, in his 87th year. He was buried at Pictou, near the scene of his early work.

Tributes from persons in all walks of life were forthcoming when his death became known. Dr. Murray MacLaren, then Minister of Pensions and National Health said in part: "His refined mind and tastes led him to be associated with all that was good, all that was patriotic, all that was noble."

The minutes of the Board of Governors of Dalhousie University used these words: "Dr. Stewart will be remembered as the surgeon who, in the Province, by his skill, raised the practice of that profession to a high plane. When he was in active practice he was the most highly respected and the best loved man in this Province."

In his memory, the Provincial Medical Board of Nova Scotia founded and endowed the Dr. John Stewart Memorial Lecture, given each year at the Dalhousie University Medical Refresher Course in Halifax. It was a humble but fitting tribute to a man, who by his character, high ideals and great professional skill, raised and ennobled the medical profession in his native province and far and away beyond its boundaries.

ORIGINAL ARTICLES

EPIPLOIC GRANULOMA DUE TO FISHBONE SIMULATING CARCINOMA*

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THE MAJORITY of granulomata occurring as a reaction to foreign substances in tissues are relatively easily diagnosed. The history of exposure to the irritating agent can usually be elicited, as in the case of paraffinoma of the face, breast or pleura, of lipoid granuloma of the lungs after the use of oily nose drops, or of granuloma following bronchography or hysterosalpingography. Granuloma of the rectum which may follow the injection treatment of hemorrhoids, beryllium lesions occurring in the lungs after exposure, and the small granulomata in the peritoneal cavity due to the powder on surgical gloves are all familiar to the medical profession. The authors would like to draw attention, however, to a form of granulomatous reaction which may produce marked abdominal symptoms and signs and which may be mistaken for extensive malignant disease. We refer to the epiploic granulomata produced as a result of perforation of the gastrointestinal tract by ingested foreign bodies, the fishbone being the most common offender.

Several reports of epiploic granulomata appeared in the European literature during the 19th century, but the first extensive account was published by Faber[1] who reported four cases in detail in 1898. He showed also that fishbones are dissolved fairly rapidly in normal gastric juice, but fail to dissolve in the presence of reduced gastric acidity. In 1907 Moynihan[2] drew attention to the difficulty of distinguishing between inflammatory tumours and carcinoma at operation. In 1927 Ginzburg and Beller[3] reported 12 cases of which five were due to chicken bones, one to a tooth pick and six to fishbones. They pointed out that in certain cases of obvious abscess, removal of the foreign body and drainage might be sufficient to effect a cure. Stetten[4] reported an additional case in the same year and Samet and Fogelson[5] reported another case in 1955. Feigen and Shapiro[6] in 1958 described a fishbone granuloma in a rectosigmoid anastomosis two years after an anterior resection and emphasized the possible confusion with recurrence of the pre-existing neoplasm. The majority of published reports on this subject have come from continental Europe.[1, 7-17] The literature in the English language is surprisingly sparse. The nine cases due to fishbone mentioned above, appear to constitute the total number to be found in the English literature. Assorted etiological objects have been reported by other authors.[18, 19]

Occasionally a mass of localized fibrosis may be found in the omentum and may appear to be idiopathic, in that no foreign body is to be found within the fibrous tumour. A possible explanation for this curious lesion has been offered by Schmieden[20] and by Lewinsohn,[21] namely that some time later the foreign body has found its way back into the lumen of the gastrointestinal tract and has been passed with the stool. Our Case 4 may constitute an example of this phenomenon.

DIAGNOSTIC FEATURES

From a review of some 70 reported cases and from our own experience, we are struck by the frequency with which the initial event of perforation by the foreign body cannot be identified from the history. Many patients do not recall any symptoms before the onset of gradually increasing pain, colic and loss of weight. Occasionally the onset can be defined by sudden abdominal pain, chills and fever, but this is exceptional in those patients in whom granulomata proceed to form. As a general rule the symptoms are increasing discomfort, obstructive crampy pains, anorexia, alterations in bowel habit, abdominal distension and progressive weight loss extending over weeks or months. The similarity of the symptoms to those of gastrointestinal can-

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cer increases the diagnostic difficulties. Some localized tenderness in relation to an irregular mass is the most common physical finding.

Laboratory studies are not particularly helpful. Mild anemia may be present. Occult blood in the stool is not usual. The erythrocyte sedimentation rate may be increased and the gastric acidity may be low.

Barium enema examination is the diagnostic aid which is most generally useful. The palpable tumour is often larger than the appearance on barium enema would suggest. Both ends of the narrowed area of bowel tend to become cone shaped,[22, 23] as compared to the sharper cut-off seen in those with carcinoma. The mucous membrane is usually intact and may be puckered in accordion fashion due to the longitudinal shrinkage of the encircling fibrotic tissue. di Rienzo and Mosca[24] have described a pharmacodynamic test in which the injection of pitressin is followed by frank activity of the muscularis mucosa which may be observed under the fluoroscope. Their paper contains good illustrations of the radiological appearance of the bowel in response to this test. A barium series is indicated if signs of obstruction are not unduly prominent.

Operative Findings

The tumour may vary in size from 2 cm. to 15 cm. It may involve the stomach, bowel, lesser or greater omentum, the mesentery or the abdominal wall. The tumour may appear to involve both the stomach and the transverse colon. In such cases the appearance is possibly due to migration of the foreign body from the stomach into the greater omentum overlying the colon.

The gross finding of an irregular whitish mass of firm to hard consistency may lead readily to an initial operative diagnosis of extensive and perhaps inoperable malignancy. Careful examination will usually reveal that there is no evidence of metastatic spread and that no intrinsic tumour of stomach or bowel is actually present. A frozen section study of a fragment of the tissue may be highly desirable and informative.

Pathology

Pathological examination may or may not reveal a necrotic abscess cavity containing the foreign body. Subacute inflammation in the form of round cell infiltration is often present. The most striking finding is the presence of solid scar tissue due to more or less mature fibrosis which may be really remarkable in its extent. Giant cells may or may not be present.

Treatment

Reports in the literature reveal a wide variety of surgical approaches to the problem of treatment. Frank abscess cavities have been opened and drained, the foreign body being recovered in several cases. Smaller tumours not involving viscera have been excised. Resections of viscera have been carried out as for malignant disease. Enteroenterostomies have been performed to circumvent obstructions.

The simplest treatment which will eradicate the lesion is clearly all that is necessary. In many cases a cleavage plane along the serosa of the affected viscus can be defined and the tumour can be excised without entering the stomach or bowel. Frozen sections should be carried out on larger tumours if there is the slightest suspicion that the tumour may be benign. Resection limited to badly involved bowel may be necessary on occasion. If the possibility of granuloma is kept in mind and the lesions are explored carefully, it should be possible to avoid unnecessarily radical operations.

Case Reports

Case 1.—A 47-year-old watchman was admitted to the Reddy Memorial Hospital, Montreal in May 1951. He gave a history of recent loss of appetite, constipation, distension and some crampy mid-abdominal pain. There was no loss of weight. He had been observed for six months because of a pulmonary lesion without proof of the diagnosis of tuberculosis. On examination he did not appear ill. Mild abdominal distension was noted and a large tumour mass was present in the mid-abdomen which was mildly tender. There were no other relevant physical findings.

Laboratory studies revealed a mild anemia, an increased erythrocyte sedimentation rate

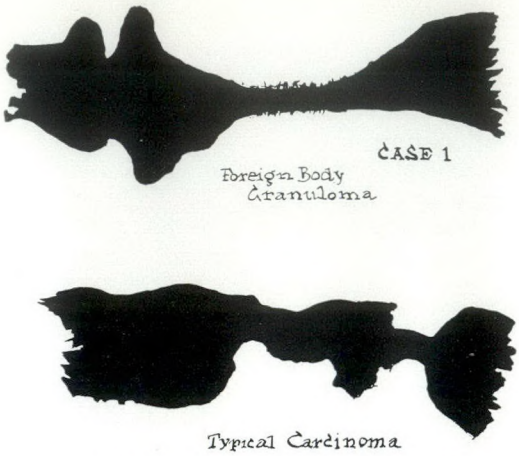

Fig. 1.—Case 1. Sketch of appearance of transverse colon on barium enema. The conical ends of the strictured bowel are shown, with the puckered but otherwise normal mucous membrane. The lower sketch shows the sharper cut-off and greater mucosal distortion of an extensive carcinoma in a similar location.

and reduced gastric acidity. The urinalysis was normal. Barium enema showed an area of stenosis in the transverse colon which was considered to be due to an extrinsic lesion. Unfortunately, the original films were subsequently destroyed. A sketch of the lesion with a comparative representation of a typical carcinoma of similar extent is illustrated in Fig. 1.

Operation was performed on May 22, 1951. There was no free fluid in the abdominal cavity and the liver was normal. The tumour was adherent to the abdominal wall from which it was separated with difficulty. The tumour measured 15 cm. in size and involved the entire omentum, most of the transverse colon and the greater curvature of the stomach. The surgeon (W. E. Kunstler) was convinced that the lesion was a carcinoma and frozen section was not performed. What was considered to be a palliative resection was carried out, with removal of 21 cm. of transverse colon and part of the greater curvature of the stomach together with the greater omentum. End-to-end anastomosis of the flexures of the colon was performed. The patient recovered satisfactorily and was discharged four weeks later. Six years later the patient was examined and was found to be well and working.

Pathological study of the specimen revealed a normal colonic mucosa with no evidence of carcinoma. In the centre of the hard, whitish-yellow tumour there were multiple abscesses, one of which contained a large fishbone. Microscopically, the mass consisted of fibrous tissue with diffuse subacute inflammatory and patchy granulomatous reaction. There was no evidence of tuberculosis or neoplasm (Figs. 2, 3, 4 and 5).

Comment

The extremely extensive epiploic granuloma misled the surgeon into the belief that malignancy was present. In this case the lesion engulfed the transverse colon to an extent which in all probability rendered resection necessary. Nevertheless, awareness of the possibilities inherent in the lesion, coupled with the use of frozen section, might have led to the correct diagnosis at the operating table.

CASE 2.—A 69-year-old man was admitted to the Reddy Memorial Hospital in December 1951. For some two months he had experienced severe left upper abdominal and left shoulder pain immediately after a meal. He had given up eating solid food because of the pain which it caused, and had lost 35 lb. weight. Abdominal examination showed some left upper abdominal and left costovertebral tenderness but no mass. There were no pertinent physical findings except those due to recent weight loss. There was mild anemia; his urinalysis was normal. An intravenous pyelogram was normal. Barium series showed a definite filling defect on the greater curvature side of the fundus of the stomach highly suggestive of carcinoma. Again, a sketch is used to depict the appearance of the original radiograph (Fig. 6).

Laparotomy revealed a tumour about 8 cm. in size, which the operator (F. N. Gurd) considered at first to be a carcinoma of the stomach at the site shown by the radiograph. However, close inspection showed that the mass involved the upturned end of the greater omentum which was firmly adherent to the fundus of the stomach, and it proved to be possible to dissect the tumour away from the stomach and from the gastrosplenic ligament. The stomach was seen then to be apparently normal. The omental mass was removed by resection of the omentum. Further search was made for a primary carcinoma as it was presumed that the tumour was a large secondary lesion. However, no other disease was found and the abdomen was closed.

Pathological study revealed a fishbone in the centre of the tumour. Microscopic findings were similar to those of the previous case (Figs. 7, 8). Postoperatively, the patient

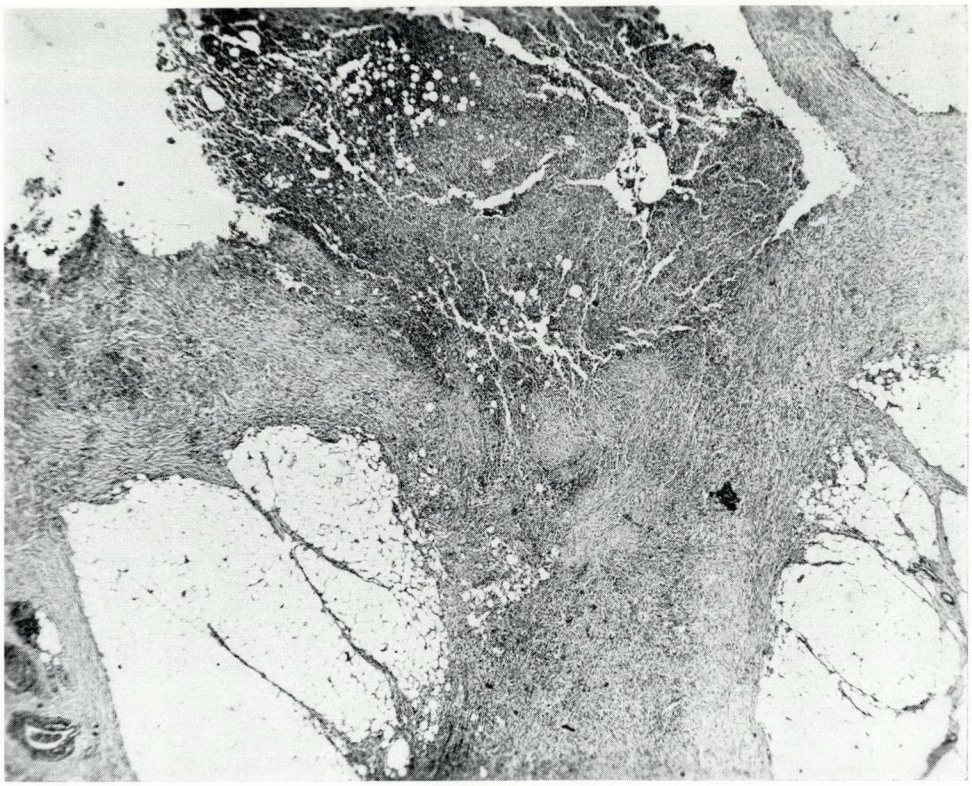

Fig. 2.—Case 1. Low power view of inflammatory exudate and fibrosis in the neighbourhood of the fishbone in omental fat (original magnification x 25).

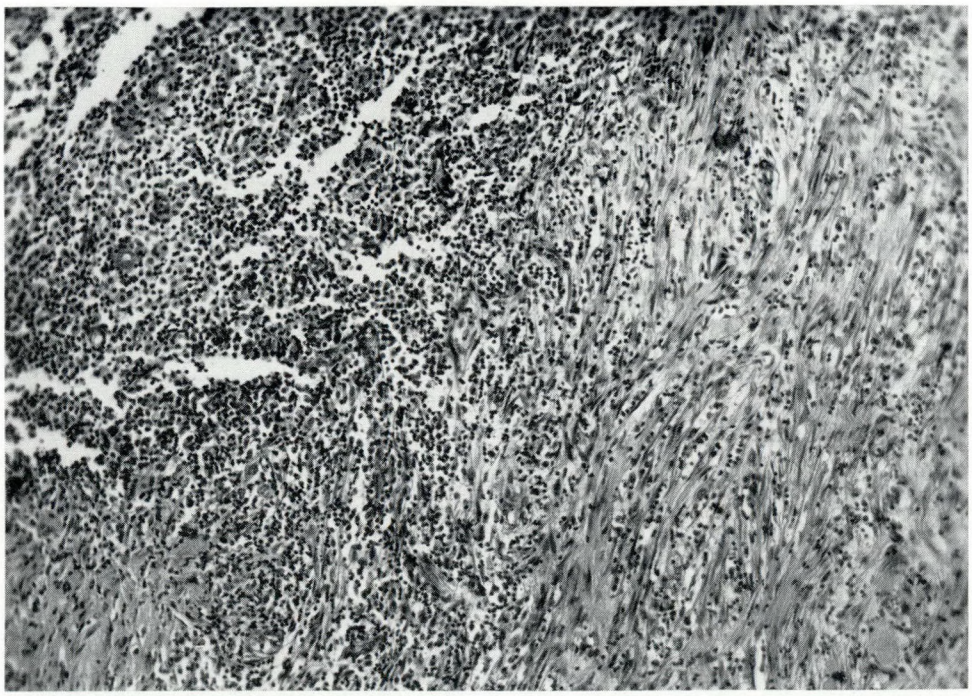

Fig. 3.—Case 1. Fibrosis and inflammation replacing omental fat (original magnification x 100).

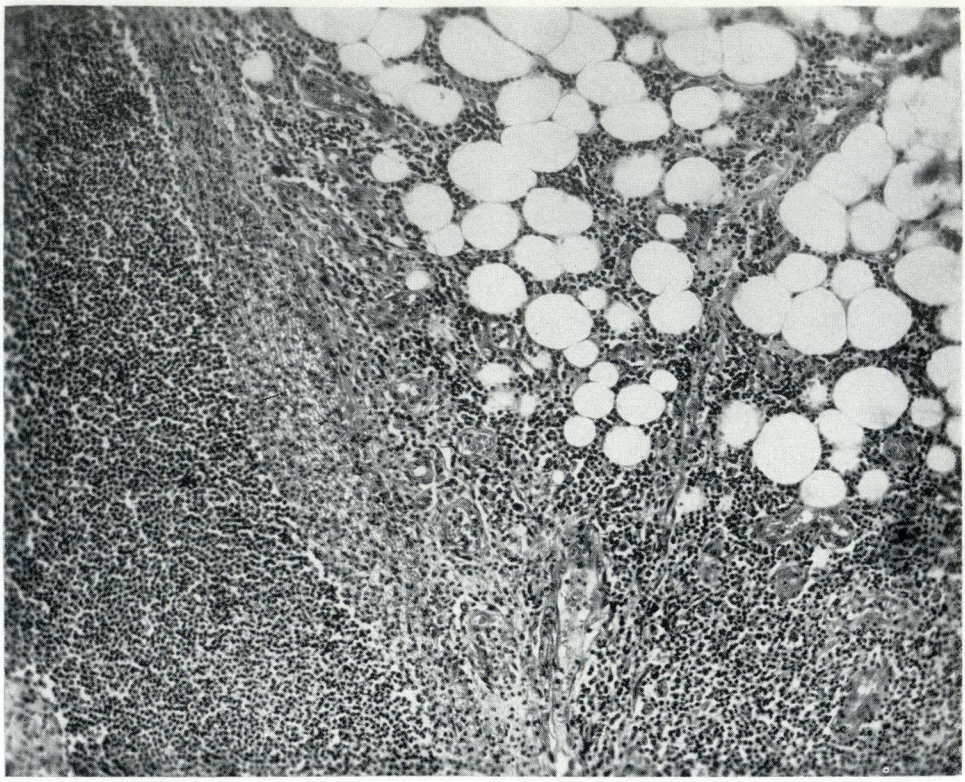

Fig 4.—Fibrosis and inflammation replacing omental fat (original magnification x 100).

added a further note to the history, conceding that his favourite breakfast was young trout, which he ate as one would eat a banana, washed down with beer.

The operation relieved his symptoms completely, and follow-up examination six years later revealed that he had remained in excellent health.

Comment

This case is one of straightforward perforation of the stomach with capture of the fishbone by the greater omentum. Symptoms were severe and the patient's life was in jeopardy due to inanition. Complete cure followed conservative operation, despite the fact that the correct diagnosis was not suspected at time of operation.

CASE 3.—A 52-year-old man was operated upon by one of us (D. W. Ruddick) in the United Kingdom in 1949. The patient gave a six-week history of pain in the left lower quadrant, with a two-week period of alternating constipation and diarrhea. Some years before he had undergone subtotal gastrectomy for peptic ulcer. On examination he was seen to be poorly nourished. The abdomen revealed a hard, irregular mass in the left lower quadrant. Barium enema demonstrated an obstructing lesion of the left transverse colon with mucosal ulceration. No other significant findings were evident except for moderate anemia.

At operation a dense, hard mass was found which appeared to arise from the transverse colon. In mobilizing the mass several small abscesses were entered. The transverse colon was mobilized and resection was carried out by the Mikulicz method.

The specimen consisted of a portion of transverse colon surrounded by a dense mass of tissue causing partial obstruction. Mucosal ulceration was present. Within the mass was an abscess cavity containing a fishbone. Microscopic study showed a similar picture to that seen in the first two cases, namely inflammation, fibrosis and no evidence of malignancy. The patient eventually recovered.

Comment

Once again the predilection of fishbones for the region of the transverse colon is demonstrated by this case. The patient

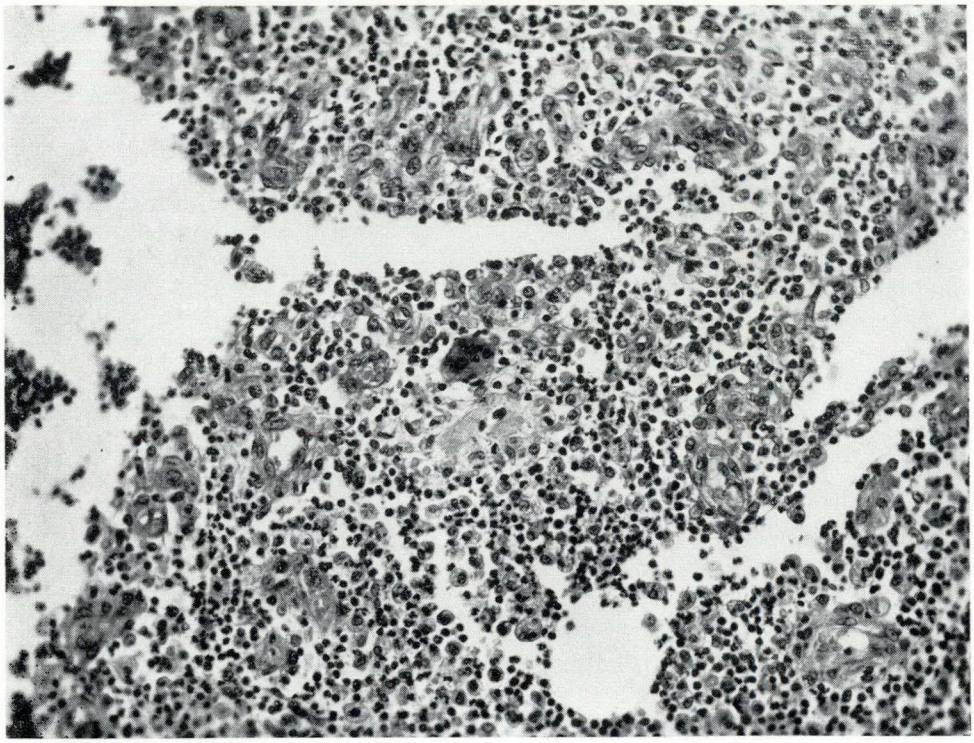

Fig. 5.—Case 1. High power view showing granulomatous reaction and giant cells (original magnification x 200).

presumably had a decreased gastric acidity as a result of his previous gastrectomy. Obstruction of the colon was almost complete and mucosal ulceration was present. The latter finding is unusual.

CASE 4.—A 29-year-old mother of two children was admitted to the Montreal General Hospital on August 31, 1960. Her past history had been characterized by frequent respiratory infections. Otherwise there were no contributory findings in her past history. Two days before admission to hospital she had noted a dull ache in the left lower abdomen. There were occasional lower abdominal cramps and some flatus, no nausea or vomiting and no distension. Her last menstrual period, 10 days before, had been normal. There were no urinary symptoms.

On examination her temperature was 99.4° F. and her pulse rate was 88 per minute. The patient appeared well. Abdominal examination revealed a fixed mass about 7 cm. in diameter below and to the left of the umbilicus. The mass was mildly tender. Rectal examination was negative, as was pelvic examination. There were no positive findings.

Urinalysis was normal, her hemoglobin was 11.7 g. %, her white blood count 10,500/c.mm. and her sedimentation rate was 12 mm./hour. A flat film of the abdomen was normal. Barium enema showed distortion and indentation of the distal transverse colon, particularly upon compression of the mass. The mucosal pattern was normal.

No definite preoperative diagnosis was possible. Laparotomy was performed (F. N. Gurd) on September 3, 1960, under general anesthesia. There was no free fluid in the abdominal cavity and no intra-abdominal abnormality other than the tumour mass. The mass was adherent to the anterior abdominal wall but was dissected free. It measured 7 cm. in diameter and was about 2 cm. to 3 cm. thick, resembling a hamburger in size and shape. It was mottled whitish-grey in colour, and was embedded in omentum and firmly adherent to the anterior surface of the transverse colon. It was possible to excise the left half of the omentum together with the mass. A cleavage plane was found between tumour and colon, revealing no disease in the bowel itself except for some thickening of the apposed bowel wall. No evidence of perforation, recent or remote, could be demonstrated. A frozen section showed no

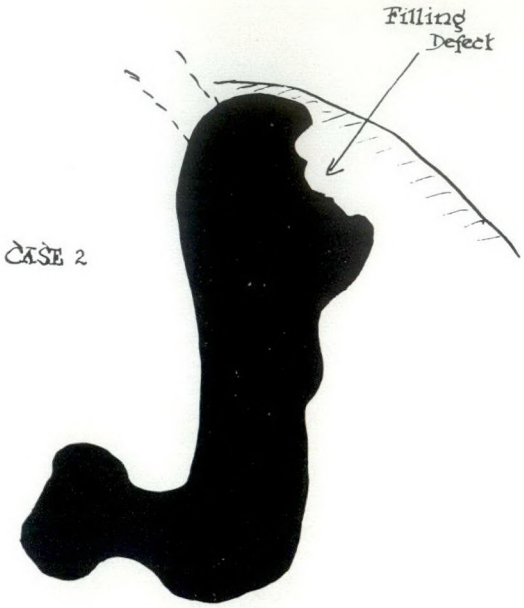

Fig. 6.—Case 2. Sketch of barium series showing indentation of gastric fundus: resemblance of filling defect to carcinoma is evident.

evidence of malignant disease. The appendix, which was normal, was removed and the abdomen was closed.

The pathology report read "localized fibrosis with mild non-specific inflammatory reaction in omentum. The fibrosis varies from young and highly active to mature, dense, collagenous tissue and hyalin. There is patchy hemorrhage, fibrinoid edema and surface fibrinous exudate. In some masses of fibrin there are large numbers of proliferating mesothelial cells. The lesion is not neoplastic; the etiology is not apparent. It is possibly related to the entity of retroperitoneal and mediastinal fibrosis." No foreign body was found within the mass, nor were there any giant cells.

The patient was discharged on September 12, 1960, and has since remained well.

Comment

The case remains unexplained and of course cannot be considered to be one of a proven foreign body granuloma. Nevertheless it is included here as an example of a lesion which could well have been mistaken for malignant disease and sub-

Fig. 7.—Case 2. Low power view of cavity in omentum which contained the fishbone (original magnification x 20).

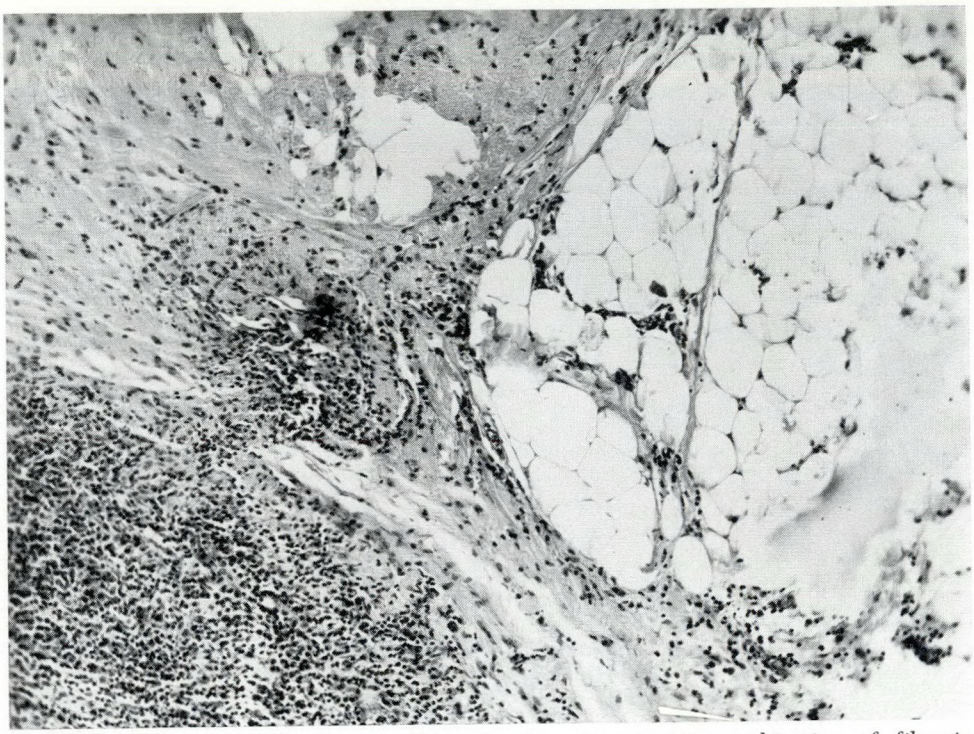

Fig. 8.—Case 2. Higher power view showing characteristic combination of fibrosis, inflammatory exudate and omental fat (original magnification x 100).

jected to radical surgery. It is not impossible that a foreign body had re-entered the bowel at some earlier date, as has been suggested by other authors.[20, 21]

Summary

A review of foreign body granulomata reported in relation to the gastrointestinal tract has been presented.

The diagnostic features, operative findings, pathology and treatment have been discussed. The diagnostic importance of radiological studies has been emphasized. The prognosis is generally good when the bulk of the tumour is removed and intestinal obstruction is relieved.

Three proven cases of epiploic granuloma due to fishbone are reported, all of which simulated carcinoma.

A case of a fibrous tumour in which no foreign body was found is also reported because of the diagnostic difficulties it presented. The possibility is considered that a foreign body may have re-entered the bowel in this case.

Acknowledgments

The assistance of Dr. Jean-Pierre Jean, Radiologist, and Dr M. B. Mackenzie, Pathologist, The Reddy Memorial Hospital, Montreal, is gratefully acknowledged. Thanks are also due to Dr. Weste and Dr. Goldberg for help in compiling the bibliography.

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RÉSUMÉ

Le granulome de l'épiploon peut atteindre tous les viscères de la cavité abdominale, y compris le péritoine pariétal et la paroi abdominale. Un certain nombre de ces granulomes son dûs au passage de corps étrangers à travers l'estomac ou les gros intestins. Parmi ces corps étrangers, les arêtes de poisson en sont le plus souvent la cause. Entre 70 et 80 cas ont été décrits, dont seulement neuf ont été observés en Amérique du Nord.

Le diagnostic différentiel de cette entité est d'autant plus important qu'il est facile de le confondre avec un cancer abdominal ayant abouti à une occlusion intestinale qui nécessite une intervention chirurgicale d'urgence. Dans ces conditions, il arrive que les lésions impressionnantes font supposer au chirurgien un état si avancé de la maladie cancéreuse qu'il abandonne toute intervention même palliative. Seulement un examen histopathologique effectué au moment de l'opération peut révéler la nature des lésions. Il est vrai que dans certains cas, l'examen par les rayons X ou des réactions pharmacodynamiques puissent la suggérer.

Le pronostic du granulome d'épiploon est favorable à condition que les masses de tumeur qui causent l'occlusion ou la perforation intestinal aient été enlevées. Des cas de guérison spontanée ont été décrits.

Trois cas de ces granulomes ont été observés à l'Hôpital "Reddy Memorial" de Montréal. Ils étaient dûs à l'ingestion d'arêtes de poisson.

POSTMORTEM HOMOGRAFTS. James Barrett Brown, M.D., F.A.C.S. and Minot P. Fryer, M.D., F.A.C.S., Plastic Surgery Service, Department of Surgery, Washington University School of Medicine, St. Louis, Missouri. 64 pp. Illust., Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $6.00.

This book describes the use of postmortem skingrafts which in many instances have saved the lives of patients with extensive third degree burns. The difficulties of gaining consent for removal of this tissue for homologous transplantation are described and the authors have overcome this problem by appealing to the humanitarian feelings of the relatives in a sympathetic manner.

The indications for use of postmortem skingrafts and methods of application are described. The equipment for operation of a Skin Bank in a hospital is described, and laboratory experiments to support the usefulness of this method of coverage of extensive granulating wounds is presented. This book is recommended for plastic surgeons, general surgeons and for those in accident services.

SURGICAL MANAGEMENT OF RECURRENT CARCINOMA OF THE CERVIX

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THERE IS still much controversy about the place of surgery in the treatment of carcinoma of the cervix. In many centres it is now believed that radiation plus radical surgery should be used in all cases where the disease is confined to the pelvis and is surgically resectable. Some feel that the improved survival rate is sufficient to justify the increase in complications and morbidity with this method of treatment.

Radiation is still the primary method of treatment at the Ontario Cancer Foundation, London Clinic. However, some indications for operation[9-11] are listed in Table I. It is in the last of these (poor response to radiation) that the author has been particularly interested over the past four years.

The radiation dosage used in the Ontario Cancer Foundation, London Clinic, is as high as that employed in most centres. The treatment consists of intrauterine and vaginal radium insertion followed by cobalt 60 therapy to the parametria. This treatment provides a dosage of approximately 8500 rads to point A and 5500 rads to point B.

TABLE I.—INDICATIONS FOR OPERATION

1. Carcinoma *in situ*
2. Young patient (may preserve ovary)
3. Pregnancy (1st and 3rd trimester)
4. Extension to bowel or bladder
5. Satisfactory radiotherapy not possible
6. Endocervical tumour
7. Intrauterine extension
8. Associated pelvic tumours
9. Pelvic inflammatory disease
10. Poor response to radiation

TABLE II.—SITES OF RECURRENCE IN 96 CASES

	Number of cases
Cervix and/or vagina	35
Parametrium	77
Pelvic wall	31
Extrapelvic	13
Unknown	2

TABLE III.—SYMPTOMS PRESENT AT TIME OF FIRST RECOGNIZED RECURRENCE IN 96 CASES (1949 - 1954 SERIES)

	Number of cases
Vaginal bleeding or discharge	22
Low back pain	15
Leg pain and edema	20
Lower abdominal pain	31
Urinary	29
Bowel	21
Miscellaneous	7

TABLE IV.—SURVIVAL TIME AFTER DIAGNOSIS OF RECURRENCE IN 96 PATIENTS TREATED BY RE-IRRADIATION (1949 - 1954)

Months of survival	*Number of cases*
0 - 6	36
6 - 12	33
12 - 24	23
Over 24	4

RADIATION TREATMENT OF RECURRENCE

During the period between 1949 and 1954 there was no surgical treatment of recurrent carcinoma of the cervix at the London Clinic, re-irradiation being the only form of therapy employed. During this period there were 96 cases of recurrent carcinoma of the cervix, approximately one-half of them recurring within six months of treatment and about 15% recurring after two years. The sites of recurrence are shown in Table II.

This reveals that a rather high percentage of recurrences when first diagnosed, involved the cervix, vagina and parametrial tissue, which would theoretically have made them surgically resectable lesions. The symptoms at the time recurrence was first diagnosed are shown in Table III.

These patients very frequently had pelvic discomfort, either in the lower abdomen or low back, but only about one-quarter of them had vaginal bleeding or discharge.

The outlook for these patients treated by re-irradiation for carcinoma recurrence is shown in Table IV. About one-quarter survived beyond 12 months and only four survived two years or longer. It should be pointed out, however, that none of these patients can be considered to have received radical re-irradiation. Of the 96 patients,

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three were believed to have remained in Stage I and 34 had not advanced beyond Stage II when recurrence was first diagnosed. Thus it was thought that nearly 40% might have been salvable by some surgical procedure. Among the first to focus attention on the surgical treatment of recurrent carcinoma of the cervix were Heyman and Belonoschkin[6] who, in 1949, reported a five-year survival rate of 29.1% in recurrent carcinoma and 12.1% in residual carcinoma of the cervix.

Surgical Treatment of Recurrence

If the diagnosis of recurrence can be made before the disease has progressed to the point at which it is necessary to remove other pelvic organs, the survival rate is markedly improved.[8, 9, 12] Early diagnosis therefore is extremely important.

Diagnosis

Frequent visits to a follow-up clinic and awareness of recurrence upon eliciting any of the complaints outlined in Table III are most important. They are especially important for the patient who has been symptom free, even if only for a short period of time, and then begins to complain. Careful abdominal and pelvic examination, the latter always including rectovaginal palpation, should be carried out at each clinic visit. Nodularity, ulceration, pelvic masses or asymmetry of the vaginal vault not previously noted, should certainly arouse suspicion.[1-4] All these points should be carefully recorded on the patient's chart at each clinic visit to provide a base line. Occasionally, hydronephrosis alone may be the first evidence of recurrent disease although this may occur as a complication of radiation treatment.[3, 4] In our experience it most often indicates recurrence. Graham reports[5] that vaginal smears will be positive in about half the cases before the diagnosis can be made on physical examination. Vaginal smears at each follow-up visit are therefore desirable.

The patient suspected of having a recurrence may lose valuable time waiting for biopsies to become positive or for definite enlargement of pelvic masses.[3-12] Absolute diagnosis may be difficult, but examination under anesthesia, and if necessary, laparotomy to be certain of the diagnosis, is not too radical in view of the extremely serious nature of the disease.[3, 4]

Surgical Cases

A study was also carried out on a group of 37 patients with recurrent carcinoma of the cervix, who had been operated upon between 1955 and 1959 with the objective of permanent cure of their disease.

Table V indicates the stage of their disease when it was first diagnosed and the stage of the disease when recurrence was recognized.

In almost every case the recurrent carcinoma was considered to be in a more advanced stage than at the time of primary treatment. It is felt that this situation could have been avoided by more intensive follow-up clinic care, and by more prompt action when recurrence was first suspected.

Preoperative preparation

Once recurrence has been diagnosed or seriously suspected, the patient should be subjected to careful physical examination with emphasis on assessment of her general condition and cardiovascular status. Attempts should be made to establish the diagnosis of recurrence by positive biopsies, whenever possible. Complete blood counts, hematocrit, non-protein nitrogen, plasma protein values and blood volume should be obtained. Radiographs of the chest and pelvic bones should be taken in an attempt to rule out possible distant metastases. Intravenous pyelograms or retrograde pyelograms are often extremely useful. If urinary obstruction is present it should be relieved and the patient's electrolyte and

TABLE V.—Stage of Disease at Time of Primary Treatment and at Time of Recurrence (1955 - 1959) 37 Cases

Stage	*At primary treatment* — *Number of cases*	*At recurrence* — *Number of cases*
I	8	1
II	22	8
III	6	8
IV	1	20

TABLE VI.—Type of Operations Employed in 37 Cases

Type of operation	*Positive lymph nodes*	*Negative lymph nodes*	*Alive and well*	*Total*
Hysterectomy and nodes	4	13	8	17
Exenteration and nodes	8	5	3	13
Inoperable	7	0	0	7
Total	19	18	11	37

other biochemical disturbances should be corrected insofar as possible before any major surgical procedure is undertaken. Cystoscopic and sigmoidoscopic examinations are generally indicated as well. Preparation of the bowel with either neomycin or a sulphonamide and streptomycin is advisable, as it is rarely possible to anticipate those surgical procedures on the bowel which may be necessary at the time of operation. Three to four thousand cubic centimetres of blood should be available for each patient.

Operative technique

Under general anesthesia the patient is examined again and unless there are new findings which contraindicate proceeding with the operation, laparotomy is carried out. At this time the peritoneal cavity, omentum, liver, bowel and periaortic glands are inspected. If no distant metastases are found, the periaortic glands are removed and a frozen section of this tissue is examined. If any tumour tissue is found in the periaortic glands we are very reluctant to proceed with the operation. If the frozen section of these glands does not reveal evidence of malignancy, and if the local mass in the pelvis seems resectable, we proceed with the operation.

The type of operation and the organs removed depends on the extent and nature of the disease. Frozen section from suspicious areas will very frequently be of some help in deciding how extensive the operative procedure should be. One should be prepared to be as radical as is necessary to remove the local disease, and the patient's chance of long-term survival should not be jeopardized by attempts to minimize the extent of the operation.

The problem of adequate and accurate blood replacement during operation is important. There are various methods by which the extent of blood loss may be estimated. One such method involves serial determinations of blood volume by radioactive isotope techniques. In the author's opinion a more accurate assessment of total blood loss is provided by the weighing of all sponges used throughout the operation.

The types of operation performed on this series of patients are recorded in Table VI.

Extension of the disease to the pelvic wall and involvement of the iliac vessels is not necessarily a contraindication to proceeding with the operation if there is no evidence of spread beyond the pelvis and if all tumour-bearing tissue, including the involved vessels can be excised. In two such cases in the series reported here, it was necessary to remove the internal and external iliac arteries and veins and part of the common iliac artery with insertion of a nylon arterial graft from the common iliac artery to the femoral artery. One patient survived seven months and died of bowel obstruction due to intraperitoneal extension of her disease. The second patient survived two years and although an autopsy could not be obtained it was believed that she died of an ascending urinary infection. Our chief experience has been with the procedure of anterior exenteration. One total exenteration with formation of a sigmoid bladder and proximal colostomy was carried out. After a short trial with the ileal bladder we have adopted the procedure of rectal bladder formation combined with a proximal colostomy so that the fecal stream does not cross the ureteral openings. These patients generally remain free of infection and quickly gain urinary control so that they void every two to four hours during the day, and with controlled fluid intake in the evenings get up to void only once or twice during the night. It is desirable that they void reasonably frequently to avoid pooling of urine and

possible hyperchloremic acidosis. In general they do better if they take a daily maintenance dose of sodium bicarbonate.

At the termination of the operation, the vaginal cuff is left open and a latex rubber drain with multiple openings, in either side of the pelvis, is attached to a Stedman pump. In this way the exact amount of pelvic drainage over the next 10 days to two weeks can be accurately estimated. This drainage is essentially serum with a small amount of blood and represents an appreciable loss of protein which must be replaced in the form of blood or plasma. This pelvic drainage is rather copious in the first 24 to 48 hours and gradually falls off thereafter, amounting to an average of about 300 c.c. per day for the first week to 10 days. In respect to their protein loss these patients are treated essentially the same as patients with burns and their protein requirements are essentially those of a patient with a 15% to 18% burn.

Postoperative care

The problem of protein replacement and electrolyte balance is extremely important during postoperative convalescence. Serum protein and electrolyte estimations are of help but in the author's opinion, a more accurate estimation of the patient's requirements is obtained by careful measurement of the body's losses during this period. This involves accurate estimates of the pelvic drainage and of the amount and composition of the urine. These, combined with the loss from the Wangensteen suction and the estimated insensible loss, provide a fairly accurate estimate of what should be replaced. Blood and plasma are used frequently to replace protein loss, and electrolytes are replaced as indicated. About the fifth or sixth day when the bowel begins to function, the Wangensteen suction can be discontinued and oral feedings slowly begun. A high protein, high vitamin diet is desirable as soon as it can be tolerated.

Complications

The complications encountered in this series of patients are listed in Table VII.

TABLE VII.—Surgical Complications (1955 - 1959)

Cardiac arrest	1
Embolism	1
Fistula	4
Infection	1

Cardiac arrest accounted for the only operative death. One patient developed an embolism from the ligated end of the ovarian vein, eight months postoperatively. At autopsy no evidence of malignancy was found. Four fistulas occurred, two vesicovaginal, one ureterovaginal and one in a patient who had had a total exenteration in which the sigmoid colon was moved down and sutured to the anus and a sigmoid bladder formed in this manner. Infection in the postoperative period was easily controlled by pelvic drainage. Kidney failure occurred in one case in which bilateral marked hydronephrosis was present before the operation. The patient withstood the procedure quite well, made a very slow postoperative recovery and died in hospital three months later. The only pathological findings at autopsy were those of bilateral pyelonephritis.

Conclusions

Constant alertness in follow-up clinics is essential for early recognition of recurrence of carcinoma of the cervix.

From a study of 133 cases of recurrent carcinoma of the cervix it is concluded that patients with certain symptoms should be suspected of having recurrence and should be watched closely.

The survival rate of these patients may be increased by earlier use of laparotomy when suspicious symptoms and signs develop.

Valuable time is frequently lost by waiting to be absolutely certain that recurrent carcinoma is present.

Re-irradiation as carried out in this series of patients was inadequate. A surgical attack on pelvic recurrence appears to have some merit.

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Résumé

Le traitement du cancer du col utérin et ses récidives est encore sujet à discussion. Le présent article traite ce sujet, basé sur un ensemble de 133 cas de récidives vus et soignés au "Ontario Cancer Foundation, London Clinic, Ontario".

Pendant la période de 1949 à 1954, la thérapeutique par irradiation fut la seule utilisée dans les récidives: ceci concerne 96 cas; parmi ceux-ci, environ un quart fut prolongé au delà de 12 mois et quatre seulement survécurent plus de deux ans.

Trente-sept patients furent revus et traités chirurgicalement. A ce propos, l'auteur insiste sur la nécessité de diagnostiquer la récidive de façon aussi précoce que possible: ceci ne peut être fait que par une surveillance clinique très approfondie, poursuivie longtemps après la première intervention. Les symptômes de récurrence sont souvent assez vagues; il ne faut pas attendre des biopsies positive ou l'apparition de tuméfactions intra-abdominales pour se décider; il faut au contraire ne pas hésiter à faire des examens sous anesthésie, ces examens pouvant être suivis et complétés par une laparotomie exploratrice en cas de doute. Si la récidive est confirmée, il faudra se livrer à une résection chirurgicale très étendue, dont l'importance variera évidemment avec la nature des lésions rencontrées. Au cours d'une intervention de ce genre, la vérification des régions douteuses par l'examen histologique sur coupes à la congélation sera des plus utiles. En outre, il convient de s'entourer de toutes les précautions usuelles en grande chirurgie, en ce qui concerne la préparation du malade et les soins post-opératoires.

Dans ces conditions, et sans radiothérapie, des résultats encourageants ont été obtenus.

FACTS OF LIVING: PUZZLE OF COURTESY*

"Because the distinguished clinician who is called upon feels honored, not to mention deeply concerned and fraternally kindly, he customarily exercises his right to decline any fee; professional courtesy is one of our very old and courtly, and benign institutions.

"The only disadvantage (as some have begun to complain) is that it deprives us of medical care. Oh, there is no hesitation about asking a colleague to manage one's coronary occlusion; the fellows rally around. But we have succeeded in educating patients to seek aid for minimal symptoms, to have a chest film routinely, and above all undergo preventive examination. We do not ask the same consideration for ourselves, or at least seem reluctant.

"There never seems to be a proper way of discharging the obligation. There are ingenious, friendly ways: wives, in conspiracy, can discover that the consultant was changing over to 16-mm.-motion picture equipment and hadn't yet bought all the appliances. Many a physician's physician is left wondering if he should open a liquor store, a camping supply shop, or a theatre ticket agency. And in 'routine' situations of preventive medicine and the like, this solution is singularly inappropriate.

"Some even cry, Abolish professional courtesy! Naturally the most 'modern' and 'practical' attitudes appear best (at the time), but it would be judicious to understand why 'this day and age' is different and, before giving it up, exactly what is so troublesome about an ancient and meaningful custom."

*Editorial: *Medical Tribune*, Nov. 14, 1960.

ACUTE APPENDICITIS PRESENTING AS SCROTAL SWELLING: REPORT OF TWO CASES

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"APPENDICITIS is the most common lesion requiring intra-abdominal surgery in childhood" (Gross). Although the etiology and specific pathology of the disease are the same in the child as in the adult, the criteria for diagnosis are different; the diagnosis is frequently more difficult to make, and the missed case runs a more rapid and lethal course.[1-8]

Appendicitis is rare during the first year of life, and is infrequently encountered during the second year; from then on it is quite common, particularly from the age of six to 12 years, according to Gross.[4]

Anorexia and vomiting are probably the most constant symptoms, together with abdominal pain. In the very young child the lack of abdominal guarding and spasm may create major difficulties in the assessment of pain and tenderness. The temperature and white blood count are often of very little help in making the diagnosis.

The presenting symptoms, especially in the young child, may at times be quite misleading, even in the presence of an admittedly suspicious history, as illustrated by the two patients reported on in this paper who presented with tender, non-reducible right scrotal swellings. It is of historical interest that during the American Civil War, appendectomy was performed on an 11-year-old drummer boy because of a scrotal mass thought to be an incarcerated hernia, which at operation was found to be a hernial sac containing a gangrenous appendix.

The following two cases illustrate an unusual pattern of presenting manifestations of this common disease.

CASE REPORTS

V.A., a 36-month-old white boy was brought to hospital with a history of periumbilical pain. Two days before admission the child experienced the onset of moderately severe periumbilical pain which had passed away in a few hours. There was no associated vomiting. Over the next two days he had only mild abdominal discomfort but was noted to be anorexic.

Physical examination at the time of admission revealed a rectal temperature of 100.6° F., and a regular pulse of 100 per minute. The remainder of the physical examination was essentially negative, except that the abdomen showed some increase in muscle tone, but was otherwise unremarkable and non-tender to palpation. Rectal examination was also non-contributory. The right side of the scrotum was red and swollen. The mother stated she had noted this scrotal swelling for the first time about six hours before admission. On palpation there was a tender mass in the right side of the scrotum which could not be reduced. The right spermatic cord appeared to be thickened and tender. The left half of the scrotum and its contents were within normal limits. Bowel sounds were decreased. The preoperative diagnosis was that of a strangulated right inguinal hernia.

At operation a horizontal incision measuring approximately 3.5 cm. in length was made in the lowermost abdominal fold above the region of the inguinal canal. A large, firm mass was found in the inguinal canal extending through the external inguinal ring into the scrotum. This was made up of a very thick-walled, inflamed and edematous hernial sac, extending down to the testis, together with the spermatic cord which was also thickened and edematous. The testis and epididymis were essentially normal in appearance and consistency. The sac was densely adherent to the cord structures. The hernial sac was dissected free from the cord structures up to the level of the internal abdominal ring. The sac was then opened and purulent fluid released. The sac was otherwise empty. Culture of this fluid revealed only a light growth of non-hemolytic streptococci. Digital examination through the neck of the sac revealed what appeared to be an edematous appendix. The sac was then ligated at its neck by means of an 00 chromic suture and the redundant portion was amputated.

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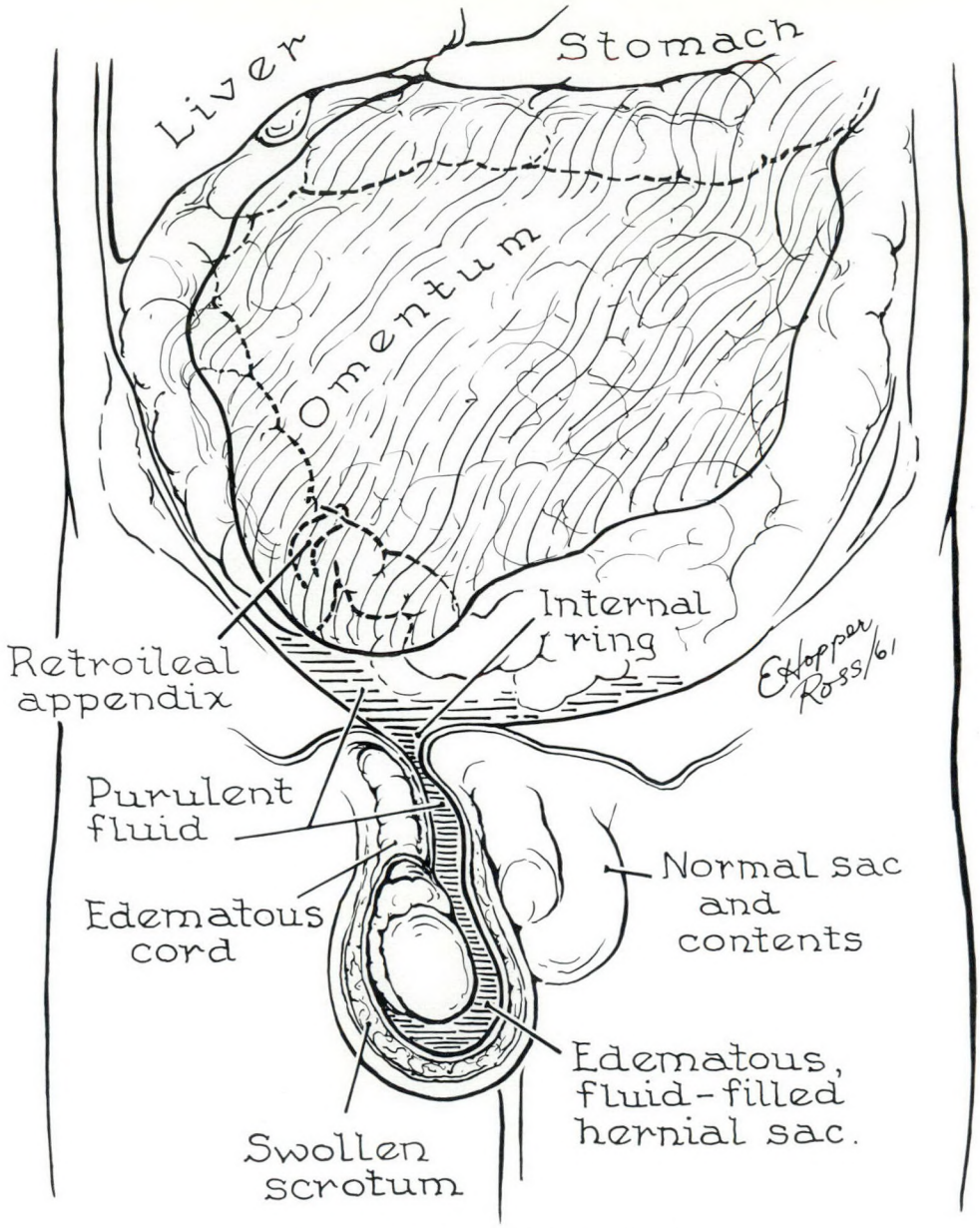

Fig. 1.—Operative findings in Case 1.

The internal ring admitted the index finger and was narrowed by means of two interrupted chromic 00 sutures. The testis was replaced in the scrotum and the usual layer closure was carried out. The abdomen was then redraped and a high McBurney incision was made. Upon opening the peritoneum purulent fluid similar to that found in the hernial sac, was encountered. A swab taken from this site was bacteriologically identical with the aforementioned specimen. The cecum was then mobilized and an acutely inflamed nonruptured appendix was found in the retroileal position (Fig. 1). There was a marked inflammatory reaction about the appendix and a moderate amount of shaggy fibrinopurulent exudate on the adjacent loops of small bowel. The appendix was amputated in the routine manner, and the appendiceal stump was inverted into the cecum by means of a purse-

string suture of 000 chromic catgut. The cecum and terminal ileum were then replaced into the abdominal cavity and a routine layer closure without drainage was performed. Interrupted 0000 black silk sutures were used to close both skin incisions.

Postoperatively the patient did well. He was maintained on intravenous fluids, and continuous gastric suction drainage until the second postoperative day and placed on pediatric Combiotic® 1 c.c. twice daily from the time of operation. This was discontinued on the sixth postoperative day, at which time he was discharged home. The incisions were well healed by primary intention. When seen in follow-up clinic one week postoperatively, there was only minimal residual non-tender scrotal swelling on the right side. He rapidly resumed normal activity and has remained well.

The pathological report was acute appendicitis with acute inflammation of the hernial sac.

CASE 2.—C.D., a 21-month-old white boy was brought to hospital by his mother because of a swelling which she had noted in his right scrotum a few hours previously, and because he had been obviously unwell for the preceding four days. Four days before admission the patient had had a temperature of 102° F., accompanied by severe and protracted vomiting, "bringing up everything he ate". He had complained of what appeared to be mild abdominal discomfort. He was seen by his doctor and at the time, a diagnosis of tonsillitis was made, and penicillin therapy was started. He improved over the next two days but remained anorexic. On the day of admission he vomited once and had two loose bowel movements which were apparently followed by the appearance of the right scrotal swelling. He was generally lethargic and his mother thought that he seemed more ill than previously.

At the time of admission to hospital his rectal temperature was 103.4° F., and his pulse was 160 per minute. He was a pale, sick-looking child, restless and irritable, lying sometimes on his abdomen with his legs drawn up and sometimes flat on his back. Physical examination revealed moderate pharyngitis. Examination of the abdomen revealed that bowel sounds were decreased but not remarkably so. There was a sensation of fullness and questionable guarding in the right upper quadrant. Examination of both lower quadrants and of the rectum was essentially negative. Examination of the scrotum revealed an elliptical, slightly tender mass which could not be transilluminated nor reduced, and appeared to be arising from above the external inguinal ring. The testis could be palpated in the distal portion of the scrotum and felt normal. The left side of the scrotum was unremarkable. The child appeared mildly dehydrated and had not voided during the 12 hours before admission. His hemoglobin at this time was 12.7 g. % though when repeated two days later after the child was well hydrated, it was only 9.9 g. %. The white blood count on admission was 6500 per c.mm.

The child was taken to the operating room and an inguinal incision similar to that used in Case 1 was made. Here again there was a bulging mass in the inguinal canal extending into the scrotum. Further dissection revealed a thick-walled edematous hyperemic hydrocele of the cord. This was dissected out intact. Aspiration of this hydrocele after it had been removed revealed that it was filled with a thin, custard-coloured, purulent material. A small hernia sac was also found proximal to the hydrocele. This was opened and was found to be empty, but a slightly fecal odour was noted and a small amount of seropurulent fluid escaped from the peritoneal cavity. The neck of the sac was suture ligated, the usual repair was performed and the inguinal incision was closed in the routine manner. Then the abdomen was redraped and a high McBurney incision was made in the right lower quadrant. Upon opening the peritoneal cavity more seropurulent fluid was found, this time with a definite fecal odour. The appendix was found in the right lateral gutter and beneath the liver in association with an incompete malrotation of the cecum (Fig. 2). A Weir extension was made in order to deal with the gangrenous appendix which was lying in a large pocket of purulent material in the lateral gutter just beneath the right lobe of the liver. The appendix was removed in the usual manner and the stump was ligated. As much purulent material as possible was aspirated from the peritoneal cavity; the incision was then closed in layers with a large corrugated rubber drain from the region of the appendiceal stump in the lateral gutter. This was brought out through the distal portion of the incision.

The child did well postoperatively. He was kept on gastric suction for two days and maintained on parenteral fluids until the third day, when clear fluids were started by mouth. He was placed on Crystamycin® 0.5 c.c. twice

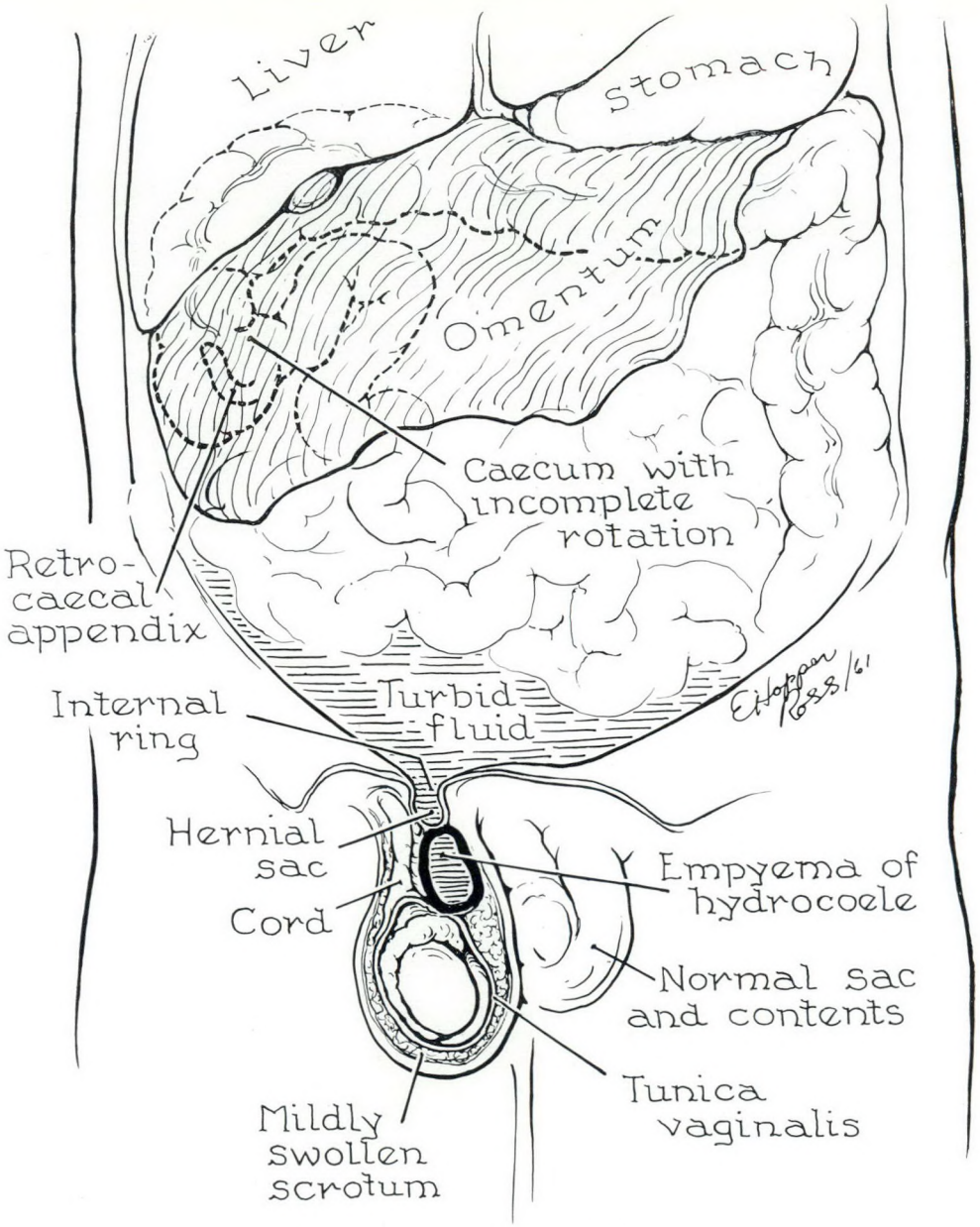

Fig. 2.—Operative findings in Case 2.

daily from the day of operation. There was a steady decrease in his temperature until it reached normal on the fourth postoperative day. The abdominal drain was removed on the sixth postoperative day and some drainage from the drain site persisted for the next three or four days.

The patient was discharged on the 12th postoperative day, and has done well since.

Cultures taken from the peritoneal cavity and from the fluid within the hydrocele both revealed *E. coli* and Bacteroides, resistant to streptomycin and neomycin but sensitive to the tetracyclines.

Both of these patients presented at the same hospital within a six-month period. These are the first two cases of appendicitis in the records of this hospital to have presented in this manner. Since both appendicitis and herniae are so common in boy children, one wonders why their coexistence is not encountered more frequently.

SUMMARY

Two cases of appendicitis have been described, occurring in early childhood, an age at which this disease frequently poses major problems in diagnosis. The presenting manifestation in both cases was a tender, non-reducible right scrotal swelling. The details of their management have been discussed. Herniotomy and appendectomy were performed on both patients with a satisfactory outcome.

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RÉSUMÉ

Deux cas d'appendicite survenus chez deux bambins à l'âge où cette condition peut poser de sérieux problèmes de diagnostic sont présentés. Dans les deux cas le point dominant de l'examen était la présence d'une tuméfaction irréductible et douloureuse scrotale droite.

Une herniotomie de même qu'une appendicectomie furent pratiquées par des incisions séparées chez les deux avec résultats excellents.

THE USE OF A DATUM*

"The ways of using a published article are many. Some among our colleagues belong to the razor-blade school and cherish the papers close to their hearts by excising them, abandoning without sorrow the shredded journal that is left. The wild ones insist they 'can find it when they need it,' meaning the select fragments, and of course W. C. Fields used to say the very thing as he clawed through his fabulous roll-top desk. The extremely sober students write for a reprint, sometimes get it, and preserve their journals and drawerfuls of reprints as well, for which, alas, there is needed an index.

"The library (when you can arrange to go there) does have several kinds of index, rather complete up to last February. The papers you have in mind were in May.

"Abstracts are an attempt to circumvent these troubles, and, as a superb form of note taking, accomplish a great deal for the mind that writes them. They are less than the data, but they can retrieve the data; now it is only a question of retrieving the abstracts. All that's wanted is an index. And maybe not, for each has a title, but the information is never looked for afterward under *that* title; it is always another reason that brings the matter up.

"These diverse forms of suffering come to mind because of new inventions by the chemists to make their information available. It must be splendid to work in chemistry and look up the data by clearly defined, fixed entities. By contrast, it is taxing to think in medicine, which is multilateral and endlessly evolving, even in its dimensions.

"If an idle genius can be found, the invention wanted in medicine is a manifold and infallible index, encyclopedic and pocketsized, that every physician can have in his desk drawer, and which guides him comprehensively to every datum he owns (or can expect to find in the library either) no matter how obliquely the occasion may evoke it. It is not, obviously, a list of chemical substances (it merely includes them) or a selection of nouns from the titles of papers (as if titles revealed much) . . . but only a genius can say what it is. The invitation is hereby extended—we will be obliged to him."

*Editorial: *Medical Tribune*, Nov. 14, 1960.

SACROCOCCYGEAL TERATOMAS IN ADULTS

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TERATOMAS of the sacrococcygeal region are relatively uncommon; less than 100 authenticated cases have been reported.[5, 12, 22, 24] Recent reviews, however, have reported a large number of cases collected from the literature.[11, 20] The earliest record of a teratomatous malformation in the sacrococcygeal area was made in about 2000 B.C.[2] The first successful surgical excision was reported by Stanley.[26]

Sacrococcygeal teratomas are thought to be invariably present at birth, and about 90% of them are recognized at that time.[5, 11, 12] They appear only rarely in adults.[3, 11, 20] They are much more common in women.[5, 11, 22]

The rarity of these tumours in adults and the previously unreported occurrence in two sisters, together with successful surgical extirpation and a complete follow-up of four to six years, have prompted this report.

CASE 1.—L.S.L., a 28-year-old, married, well developed, white woman was admitted to hospital on April 24, 1954, complaining of low backache and a mass in the lower abdomen. She was unaware of this mass until she consulted her doctor because of sterility and inability to perform sexual intercourse satisfactorily. A large pelvic mass was discovered on this visit and hospitalization was advised. Menstruation had been regular and the last normal menstrual period had been on April 2, 1954. She had suffered from constipation ever since childhood and had taken laxatives regularly. She had no urinary complaints. There was no history of any congenital anomaly or of twins in the family.

Physical examination revealed a large, firm, fixed mass, the size of a 26 weeks' pregnant uterus in the pelvis, attached to deeper structures. No fetal parts or heart sounds could be made out. Rectal and pelvic examinations revealed a huge, cystic mass, situated posterior to the vagina and rectum. No cervix or uterus could be felt separately. Her blood pressure was 110/60 mm. Hg and her pulse rate was 90 per minute.

Investigations.—Her hemoglobin was 12.8 g. % (82%), with a total red blood cell count of 4.18 million/c.mm. and a colour index of 0.9. Her total white blood count was 6900/c.mm. with a differential count of neutrophils 74%, stab cells 4%, lymphocytes 21% and monocytes 1%. The platelets and red blood cells appeared normal. Her blood group was A. Wassermann and Kahn tests were negative. The urine and stool were normal.

Radiology.—Radiographs of the abdomen and pelvis showed deformity of the sacrum and absence of the coccyx possibly due to a congenital anomaly and associated with a spina bifida occulta of the sacrum. A large soft tissue shadow was visible in the pelvis. There was no evidence of calcification in this mass. The skull, the rest of the spine and the chest were normal. A barium enema showed the rectum to be displaced to the right side. The remainder of the colon was lengthened and markedly redundant.

Frog tests and Aschheim-Zondek tests of the urine were repeatedly positive.

Operation.—The patient was operated upon on April 28, 1954. A long, midline, infraumbilical incision was made. The uterus was small but normal in shape. Both tubes and ovaries were normal. There was an enormous cystic mass present behind the rectum and pelvic colon, pushing all the pelvic viscera forward against the abdominal wall. The pelvic peritoneum was divided between the uterus in front and the rectum behind, and the incision was carried laterally. Ureteric catheters were inserted preoperatively to prevent any damage to the ureters. Both ureters were clearly defined and the pelvic colon was mobilized. The cystic tumour could then be clearly visualized; 1000 c.c. of clear fluid was aspirated from the tumour and the cyst was laid widely open. It extended down to the sacrum, coccyx and perineum. On the anterior wall of the cyst at the level of the pelvic floor, a second semisolid tumour could be palpated. With careful dissection, the entire cyst and the semisolid tumour were removed completely. The semisolid tumour showed caseous

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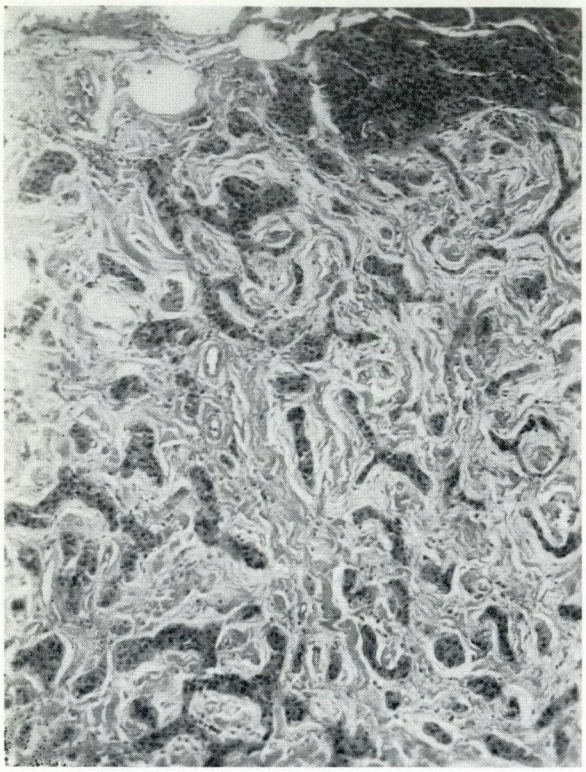

Fig. 1.—Wall of cyst containing an apparently invasive epithelial ingrowth which in none of 19 sections examined extended to the margins of resection. Endodermal components were lacking (x 100).

cheesy material. Most of the raw areas were reperitonealized. The wound was closed in layers with drainage. The ureteric catheters were removed at the completion of the operation.

The postoperative period was uneventful and the patient made an excellent recovery.

Histopathology.—Histopathological study of the excised tissue revealed an unusual congenital anomaly of the presacral region comprising a biloculated cystic structure with walls rich in smooth muscle. The smaller of the two locules was lined by stratified squamous epithelium and distended by keratotic debris and squames. Embedded in its walls were a few sweat glands and hairs.

The larger of the locules was bordered by a moderately heavy zone of acellular hyaline connective tissue so that with the smooth muscle bands in its walls, it had features of a lymphogenous cyst. In one area in the wall of this cyst, epithelium resembling that of sweat glands was growing as a highly differentiated carcinoma (Fig. 1).

The pathological diagnosis was a highly differentiated carcinoma (apparently arising from heterotopic sweat gland epithelium) in a presacral bidermal cystic congenital anomaly, growing in part as a so-called dermoid cyst.

The Canadian Tumour Registry, however, did not find evidence of malignancy in the cyst wall.

The patient was given postoperatively deep x-ray irradiation of 4000 r.

Follow-up.—The patient has remained symptom-free since operation and all the radiological investigations carried out recently have not revealed any local recurrence or distant metastases.

Case 2.—R.L., a 28-year-old, married, well-built, white woman, younger sister of the previous patient, was admitted to hospital on July 9, 1956, complaining of a profuse, thin, yellowish discharge from the rectum for the previous month. She had no urinary complaints. Her menstrual history was normal. Date of the last normal menstrual period was July 2, 1956. She had delivered a normal full-term baby six months earlier but it had died immediately after birth.

Physical examination revealed a large cystic mass behind the rectum extending up to the anterior aspect of the sacrum. A pelvic examination was normal. Her blood pressure was 110/80 mm. Hg and her pulse rate was 80 per minute.

Investigations.—Her hemoglobin was 13.3 g. % (85%); total red blood cell count was 4.4 million/c.mm. and colour index 0.96. The total white blood count was 6200/c.mm. of which 59% were neutrophils. Platelets and red cells were normal; the mean corpuscular volume was 88 c.μ, and mean corpuscular hemoglobin concentration 34%. Wassermann and Kahn tests were negative. The urine was normal. Culture from the discharge grew colonies of coliform species, and rare colonies of paracolon species.

Radiology.—Radiologically, there was evidence of a congenital anomaly of the sacrum with marked deformity of the lower portion of the sacrum and a rudimentary or absent coccyx. On barium enema, there was displacement of the rectum and lower sigmoid to the right, and of the terminal ileal loops upwards, by a mass of soft tissue density which occupied the right half and the mid-portion of the pelvis.

Operation.—Operation was performed on July 18, 1956. A posterior "T" incision was made over the sacrococcygeal region and carried down to the bone. The coccyx was disarticulated, removed and the anococcygeal

raphe was divided. The rectum was pushed forward, entering the presacral space. The cyst was immediately opened and a large amount of thin, clear-coloured fluid escaped. Anterior to it was a second lesion which was secondarily infected and which had formed a fistula into the anal canal just inside the sphincter. Both the cysts were dissected out completely and removed. The fistulous communication into the rectum was closed. The wound was then lightly packed open. The upper and lower portions of the incision, however, were loosely sutured. Postoperative recovery was uneventful.

Histopathology.—On histopathological examination of the operative specimen it was noted that most of the cyst wall was lined by stratified squamous epithelium supported by inflammatory granulation and scar tissue enclosing strands of smooth muscle. Peripheral to this lay the fibro-fatty connective tissue containing occasional lymphoid follicles. At some points, the supporting collagenous connective tissues deep to the squamous epithelial lining contained microcystic structures lined for the most part by stratified, squamous epithelium, but with areas of a columnar type of epithelial lining (Fig. 2). Scattered gland-like structures were lined by a single columnar mucus-secreting type of epithelium. In some areas, the three varieties were intermixed.

The overall picture was consistent with an inflamed and probably infected sacrococcygeal teratoma.

Follow-up.—The patient has remained symptom-free and has no complaints.

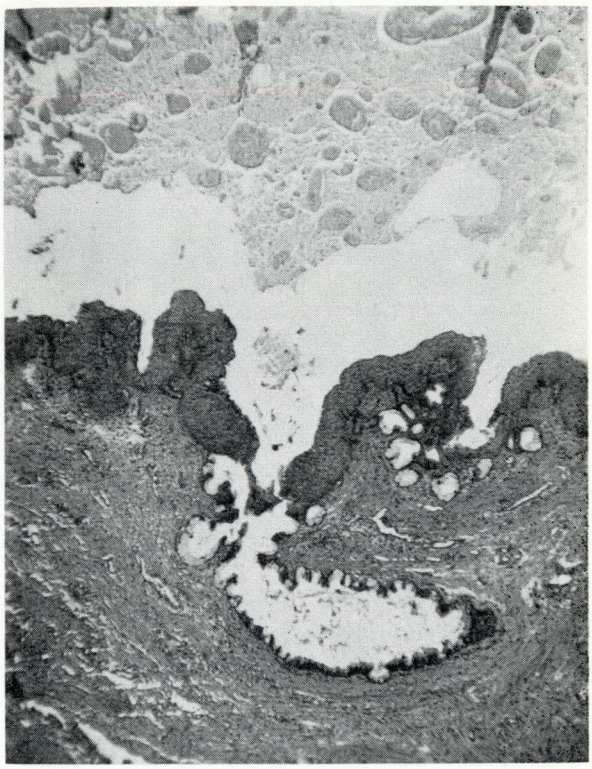

Fig. 2.—Wall of cyst lined by squamous epithelium, with gland-like structures and outpocketings lined entirely or in part by columnar mucus secreting epithelium (x 40).

Discussion and Comments

A review of the literature on the subject of sacrococcygeal teratomas has revealed a frequent interchange of the terminology of "dermoid cyst" and "teratoma". In most instances in which the term dermoid cyst was used, the tumour was a true teratoma.[7, 17, 29, 30] The attempt to classify sacrococcygeal growths as "dermoids", "teratoids", "included twins" and "fetal parasites" should be avoided; it is better to group all of these together under the one general term of "sacrococcygeal teratoma".[11]

As the teratomas combine the problems of congenital abnormality with those of neoplastic growth, it is small wonder that the literature concerning the origin and causes of teratomas is so confused. Similar benign testicular tumours occur in young horses.[28] Teratomas have also been produced experimentally.[17]

In our present state of ignorance only general assumptions as to the natural origin of these tumours can be made. Parthenogenetic development of the individual's primitive germ cells, migrating and lodging in the sacrococcygeal region might give rise to these tumours.[16] Other authorities believe that they arise primarily from cells already present in the sacrococcygeal region in the normal embryonic development, such as those of the postanal gut and neurenteric canal.[14] It can be said, however, that numerous theories still in acceptance should be discarded on the basis of recent advances in embryology and the excellent pathologic studies that have been recorded.[18]

Recent discoveries have made the family history and account of pregnancy, as with any other congenital abnormality, a matter of importance. The pregnancy may have been abnormal.[9] Although a significantly

higher occurrence of twinning has been reported in the history of these patients, other malformations have been rare.[11] Abnormal endocrine activity has also been reported.[23] The first patient described in this report also showed evidence of hormonal activity by repeatedly positive A-Z tests.

Teratomas are composite masses possessing more than one germinal layer. Wherever adequate examinations were made, tissues representing all of the three germinal layers were found in the large majority of cases. A wide range of tissue maturation may be found from case to case and indeed in different portions of one specimen. Some tumours are composed almost entirely of cells from a single germinal layer; careful search is required to demonstrate the other cell components and recognize the teratomatous nature of the mass. Sacrococcygeal teratomas may pursue one of two courses. They may persist as benign, well-encapsulated, cystic or solid lesions that grow at about the same rate as the host and are symptomatic only by virtue of their size or by displacement of adjacent organs, as in Case 1. Conversely, one element may at any time discard its mantle of benignancy and burst forth as a rapidly growing tumour. In a few instances, even incomplete removal seemed to stimulate an apparently innocuous lesion into hopeless malignancy.[11]

The growths present a wide variety of gross appearances. In general, largely cystic masses are more apt to be relatively benign, although such relationship may not always be found. Usually both solid and cystic forms are intermingled in an irregular way. Some specimens contain hair or sebaceous material; others have clear yellow or cloudy fluid. Microscopically, all types of tissues have been encountered.

These tumours may attain a large size before they are discovered, as was noted in our patients. They originate either dorsally or ventrally in relation to the sacrum.[9] The patient usually seeks medical care because of secondary symptoms which develop as a result of interference in function of the adjacent organs due to pressure by the growing mass.[8, 25] Such symptoms include disturbances in micturition, defecation, backache or sciatica. Inability to perform sexual intercourse and sterility were the presenting symptoms in our first patient. Infection with formation of a sinus may be another symptom, as in our second case. The large majority, however, complain of a mass. Increased development may be seen in some cases.

A tumour mass is visible in the majority. Associated congenital anomalies such as a three-lobed left lung,[16] a meningocele with spina bifida,[1] imperforate anus,[24] club foot,[4] and simple spina bifida,[21] have been reported.

The usual complications of these lesions are due to pressure, obstruction of the rectum and urethra with compression of the ureters against the pelvic brim, necrosis of skin and fistula or sinus formation. Infection may result from necrosis of the tumour and ulceration of the skin or rectum, or wound breakdown after incomplete removal. The incidence of malignancy has been reported as varying from 9%[5] to 17%[22] in the reviewed cases. Appearance of malignancy did not seem to be correlated with the duration of symptoms or with the size of the tumour.

In the differential diagnosis, meningocele[6] can sometimes be easily excluded by physical examination.

Neurological defects in the legs or radiological evidence of sacral deformity are highly suggestive of myelomeningocele. Myelography seems unnecessary, but in cases of doubt, it may be of help.

Chordoma may occur in this region in adults. It is more frequent in men and characteristically destroys the regional bone which is a rare finding in sacrococcygeal teratomas.

Exceedingly rare tumours, such as ependymomas, may also be present in the sacral area. These originate from ependymal cells lining the central canal of the cord and erode bone by pressure necrosis.

Pilonidal cysts and sinuses may be easily differentiated. In some cases, however, it may be impossible to differentiate a small teratoma with a draining sinus from an infected pilonidal sinus. Only histological studies will provide the correct diagnosis.

Diagnosis may be helped by the aid of

rectal examination, cystogram, barium enema and roentgenograms of the pelvis. Large numbers of cases may show calcium within the tumour on radiography.[22] The presence of bone or teeth within the lesion, or erosion of the neighbouring bony structures may be found. Aspiration biopsy is usually not advocated because of the inherent danger of dissemination.

Surgical removal is the treatment of choice regardless of the size of the tumour. If the tumour can be completely extirpated the prognosis is good. If skeletal or pulmonary metastases are present, obviously little will be accomplished by local excision. In the majority of instances the perineal or posterior approach has been used. The entire coccyx should always be excised along with the neoplasm, because microscopic nests of neoplastic cells are commonly found in, or immediately adjacent to this bone. In none of the cases reviewed, except those of Jones[15] and one of ours, has an anterior approach been utilized. A combined abdominal and sacral approach has been suggested if the tumour should prove too large or too extensive for a simple posterior excision.[4]

Preoperative irradiation is unwise because of the usual resistance of teratomas to irradiation[13] and because of the problems introduced by radiation of the pelvis, sterilization of the gonads and damage to epiphyses. In cases in which malignant change has been found in the excised tumour, as in our first patient, postoperative irradiation may be of value,[22] but it appears to be largely symptomatic and palliative. At present the only hope of cure appears to be early and adequate excision.

From the available statistics,[11] it is obvious that the outlook is far better for the sacrococcygeal teratomas in the newborn group than for those in older subjects. Pathologic examination of these neoplasms does not necessarily predict accurately the prognosis in any given case, as is illustrated by the report of our first patient. An optimistic attitude should be adopted towards sacrococcygeal teratomas, because now there is adequate proof that a good number of such patients can be cured if prompt and adequate surgical removal is undertaken.

Summary

A summary of the knowledge relating to teratomas in the sacrococcygeal region, commonly reported in the literature as "dermoid cysts", is presented.

Two successfully treated cases in two sisters, with a long term follow-up, are presented.

Acknowledgment

Our thanks are due to Dr. J. S. Campbell, Associate Professor of Pathology, University of Ottawa, for the histopathological study of the material; and to the Medical Superintendent, Ottawa General Hospital, for allowing us to publish these cases.

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Résumé

Cet article présente les cas de deux soeurs âgées d'environ 28 ans, présentant une pathologie très semblable. Dans les deux cas les symptômes étaient: présence d'une masse abdominale dure, située dans la région basse du ventre entre le rectum et la paroi abdominale postérieure, adhérente aux plans profonds; des douleurs vagues dans la région sacrée et une constipation chronique complétaient le tableau. Ces tumeurs furent enlevées, l'une par laparotomie et l'autre par voie perinéale; les suites post-opératoires furent très bonnes. Il s'agissait les deux fois de tératome sacro-coccygien.

Dans la littérature, une certaine confusion existe quant à la terminologie et la classification de ce type de tumeurs. On parle indifféremment de tératomes coccygiens de kystes dermoïdes ou de teratoïdes. Ces tumeurs combinent deux facteurs importants: une malformation congénitale et une croissance néoplasique. L'embryologie n'apporte que peu de lumière sur le premier de ces points: on sait que l'on y retrouve toujours des tissus dérivés des trois feuillets primitifs; des phénomènes de parthénogénèse ont été invoqués.

Le traitement de choix est l'ablation chirurgicale totale, sans considération de la taille; le coccyx devra être réséqué, car des petits ilôts cellulaires néoplasiques peuvent s'y trouver, provoquant des récidives. Lorsque l'ablation a été bien complete, le pronostic est bon.

DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL SURGERY. Hamilton Bailey, F.R.C.S., F.A.C.S., F.R.S.E. Emeritus Surgeon, Royal Northern Hospital, London, Consulting Surgeon, Italian Hospital, General Surgeon, Metropolitan Ear, Nose and Throat Hospital, Vice-President, International College of Surgeons. 13th edition. 928 pp. Illust. John Wright & Sons, Ltd., Bristol, England; The Macmillan Company of Canada Limited, 1960. $12.75.

Twenty editions, five in foreign languages, and 11 reprintings in 33 years should be ample recommendation for a book on any subject. This is the success story of Hamilton Bailey's 'Physical Signs in Clinical Surgery' which has now appeared in a completely new form encompassing an unique and fascinating collection of what must include all the known physical signs and clinical diagnostic methods available in surgery today. The illustrations are superb in quality and quantity, and in teaching value, and the reader is never required to hop about from page to page to place the written text with its visual accompaniment.

In this modern day of laboratory worship, it is encouraging to see just how far to reaching the correct diagnosis a careful physical examination can carry the surgeon. One's only regret is that its present size makes it more of a text than was its predecessor the coat-pocket companion. This classic, however, remains supreme in its field and must be required reading for every medical student. It will, no doubt, also remain the close ally of the fellowship candidate as well as a bedside consultant of the practicing surgeon and teacher.

LONGEVITY IN GASTRIC CANCER*

R. WILSON, M.D., F.R.C.S.[C], *Vancouver, B.C.*

OF ALL THE diseases that beset man, few are more insidious in their onset or pursue a more lethal course than carcinoma of the stomach. While the death rate from gastric carcinoma is sizable in most hospitals (2.5% of the last 12,000 postmortem examinations at the Vancouver General Hospital), statistics show that throughout the North American continent the rate is slowly but steadily declining. The reason for this is not clear. In British Columbia the drop was from 26.2 per 100,000 population in 1937 to 19.7 per 100,000 in 1957.

In a recent private canvass of surgical colleagues in Vancouver, none could recall from personal experience more than one or two instances in which a patient with gastric cancer had survived five years following operation, and most could recall no such instance. When such survivors were recalled, it was not uncommon for the surgeon to volunteer surprise that this was the case, in view of the extent of the disease found at operation which had led to the performance of a restricted resection with palliative intent only. For this and other reasons it was considered that a comparative study of all the features related to the neoplasm and its host in such a group of long-term survivors compared to those of a selected group of short-term survivors, might bring forth some significant features common to longevity or to rapid dissemination and early demise.

Thirty-six well documented cases of cancer of the stomach who survived five to 10 years after gastrectomy comprised the long-term survivor group. Some of these are still living with or without demonstrable disease; others have died of their malignancy or from some unrelated cause. The average period of survival was eight years. An equal number of cases of gastric cancer with survival of less than four years after gastrectomy were selected from local hospital records of the same period. The average duration of survival of these subjects was 19 months. Their selection was designed to provide for more realistic comparison of the two groups as shown in Fig. 1. Only those cases were included in which the objective of treatment had been definite cure by surgical ablation, and in which the findings at operation indicated that the disease was confined to the stomach and perigastric lymph nodes. If the growth was found to be adherent to surrounding structures including the transverse mesocolon, the patient was not included in this study. Gross evidence of celiac or peripancreatic node involvement, visceral metastasis noted at operation, or histological evidence of tumour extension up to the line of resection in the necropsy specimen were also causes for exclusion. Those with local involvement of the gastric serosa were considered acceptable for inclusion in the short-term survivor group. Those who died in the immediate postoperative period were excluded. All patients had evidence of death from gastric cancer on postmortem examination.

This study does not deal with operability, five-year survival or operative mortality rates, since it is purely a selective comparison. These matters embodying some of this material are being reported elsewhere.

The average age was not dissimilar in the two groups, being 62 years in the long-term and 63 years in the short-term survivors. The sex incidence in this disease is

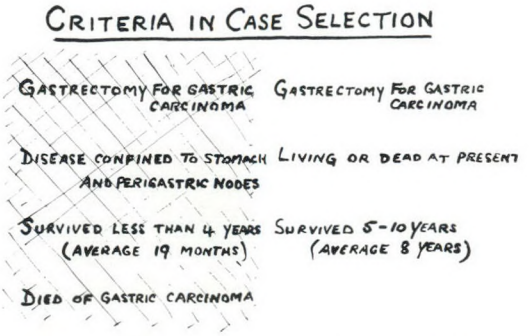

Fig. 1.—The criteria employed in selection of cases for comparison. Shaded area represents short-term survivors; clear area represents long-term survivors.

*Presented at the Annual Meeting of the British Columbia Surgical Society at Harrison Hot Springs, May 5-7, 1960.

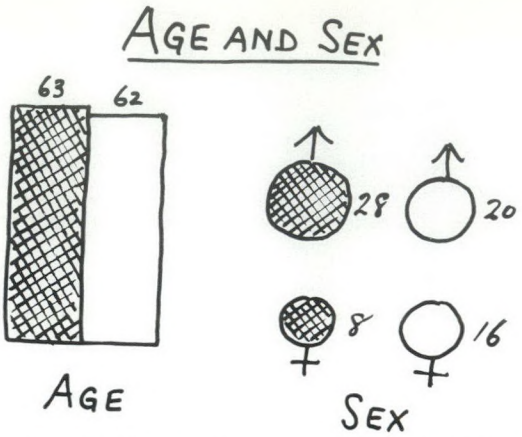

Fig. 2.—Comparison of age and sex incidence in whole numbers of short-term survivor group (shaded areas) and long-term survivor group (clear areas).

generally reported to be about 2.5 men to one woman. The comparative hardiness of women with respect to gastric cancer is reflected in both groups. Among the long-term survivors the ratio was 20 men to 16 women, and in the short-term group it was 28 men to eight women (Fig. 2).

Pain was the most frequent presenting symptom and was noted by 21 of the long-term and 26 of the short-term survivors. Next came weight loss with an incidence of 19 in each group. A close third was vomiting which affected 16 of the long-term and 18 of the short-term survivors. Less frequent symptoms with their respective incidences in the long-term and short-term survival groups included loss of appetite, 10 and 12; indigestion, 14 and 12; weakness, six and 10; blood in stools,

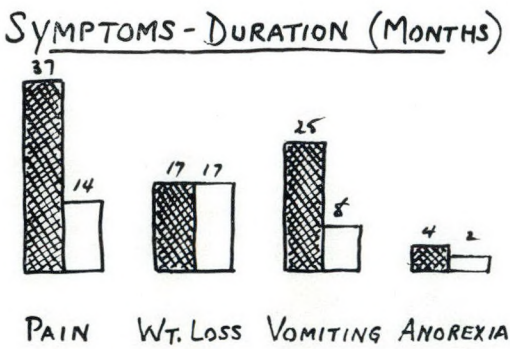

Fig. 3.—Comparison of duration of symptoms in months in short-term (shaded) and long-term (clear) survivor groups.

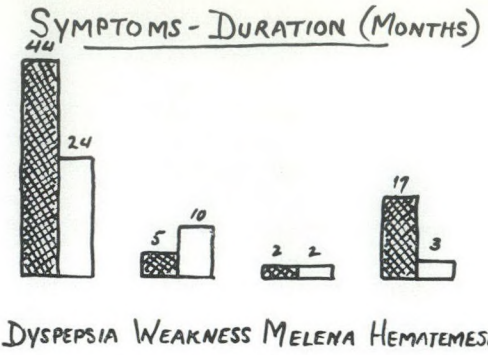

Fig. 4.—Comparison of duration of symptoms in months in short-term (shaded) and long-term (clear) survivor groups.

three and four, and bloody vomitus, one and three.

The duration of these symptoms was of some interest (Figs. 3 and 4). With the exception of weakness the reported duration of symptoms was shorter among the long-term survivors than among the short-term survivors. This finding supports the studies of Barclay,[1] but is directly opposed to those of Swynnerton[4] which uphold Macdonald[3] in his philosophical concept of biological predeterminism as a limiting factor of curability. The duration of symptoms in months, first with respect to long-term then to short-term survivors was as follows: pain, 14 and 37; weight loss, 17 and 17; vomiting, eight and 25; loss of appetite, two and four; indigestion, 24 and 44; weakness, 10 and five; bloody stools, two and two, and bloody vomitus, three and 17.

On physical examination abdominal tenderness was elicited in four of the long-term and 11 of the short-term survivors; an epigastric mass was discovered in four of the former group and in 10 of the latter. The laboratory findings were roughly comparable in the two series. Occult blood was found in stools of 27 of each group. Achlorhydria was present in 24 of the long-term and 27 of the short-term survivors. The sedimentation rate was raised in 26 of the long-term and in 30 of the short-term survivors. In the long-term survivor group only 13 had a hemoglobin reading of less than 80% and three had leukocytosis, whereas in the short-term survival group these figures were 11

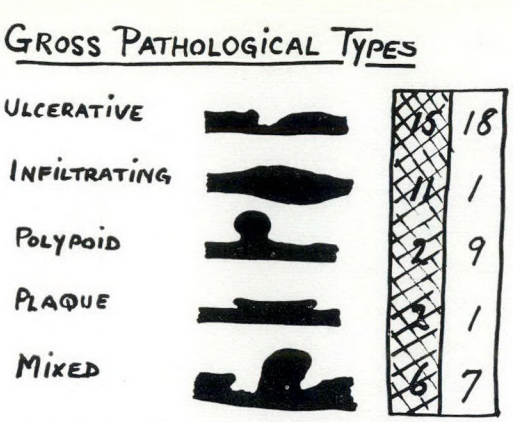

Fig. 5—Incidence in whole numbers of the various gross pathological types of tumour compared. Shaded area represents short-term survivor, and clear area long-term survivor group.

and two respectively. Radiographic studies with contrast media in the long-term survivors were positive in 21, doubtful in eight and negative in seven. In the short-term survivors these figures were 19, 13 and four respectively.

The site of the primary growth in the stomach was comparable in the two series. In the long-term survivors it was located in the cardia in three cases, the body in eight, pylorus in 23 and involved the entire stomach in two instances. Among the short-term survivors the site of the primary growth was the cardia in five, the body in 10, the pylorus in 20 and the entire stomach in one case.

The incidence of different gross pathological tumour types was notable as shown in Fig. 5. Those with polypoid cancers were predominantly long-term survivors in the ratio of 9 : 12, while those with infiltrating growths were predominantly short-term survivors in the ratio of 11 : 1. Ulcerative tumours were the most common in each group, affecting 18 of the long-term and 15 of the short-term survivors. Mixed types were next in frequency, seven occurring in the long-term and six in the short-term survival series. A plaque was infrequent, only one such instance being found in the long-term and two in the short-term survivor groups. Carcinoma originating from a peptic ulcer occurred only once among the long-term but three times among the short-term survivors.

Histological evidence of neoplastic extension to perigastric lymph nodes and neoplastic penetration of the serosal coat of the stomach were less common among the long-term survivors, 15 and 10 respectively, than among the short-term survivors, 24 and 19 respectively, as might be expected (Fig. 6). That the former figures were as high as they were, was unexpected. There was no significant difference in the histological grading of the tumours in either group. Grade 3 and 4 tumours comprised 24 of the long-term and 25 of the short-term survivors. Grade 1 and 2 tumours comprised 12 of the long-term and 11 of the short-term survivors. Excessive mucoid production was seen in only one of the long-term survivors but appeared in seven of the short-term survivor group.

The lymphocytic response of the stomach and perigastric lymph nodes was compared in the two series. The histological patterns described by Black, Opler and Speer[2] as being significant locally in the stomach, namely diffuse lymphocytic infiltration and follicular reaction; and in the perigastric lymph nodes, namely sinus histiocytosis and follicular reaction, were each assessed blindly by a competent pathologist, as to their extent. Grade 1 represents a mild degree and grade 4 an extreme degree of these various processes (Figs. 7 and 8). A summation of these counts for each process showed a significantly increased lymphocytic infiltration of the affected stomachs and follicular reaction of the perigastric lymph nodes among the long-term survivors, 84 and 60 respectively,

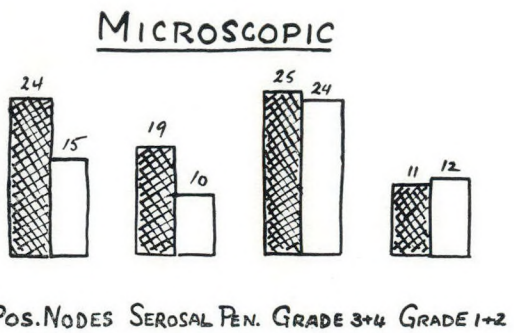

Fig. 6.—Comparison of the incidence in whole numbers of perigastric lymph node involvement and serosal penetration by tumour; also histological grading of the tumour. Shaded areas denote short-term and clear areas long-term survivors.

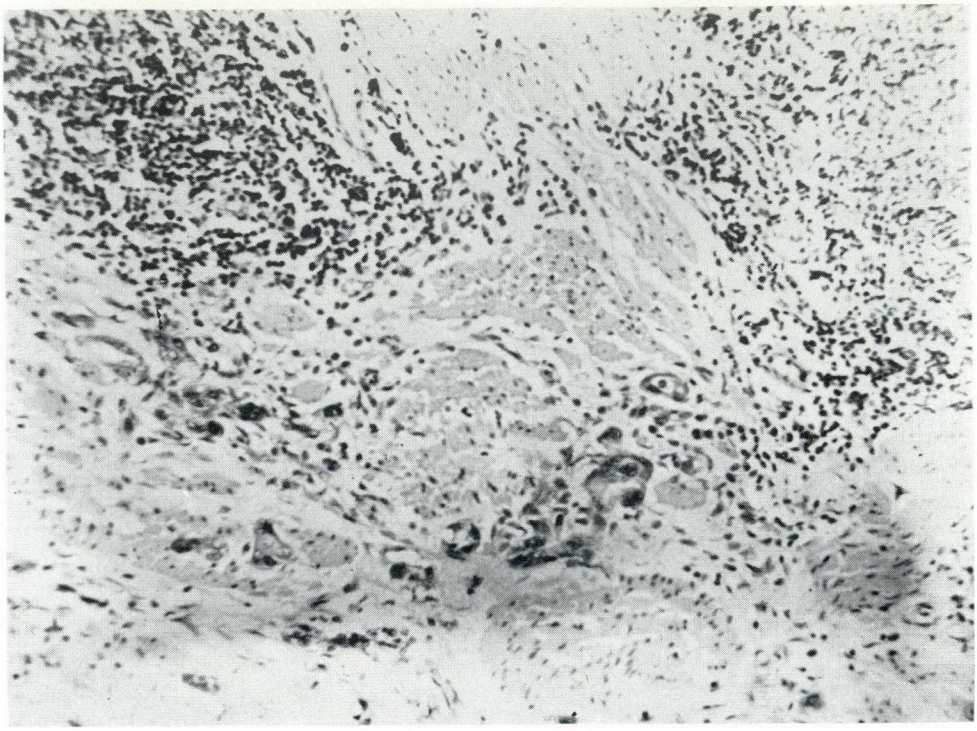

Fig. 7.—Grade 2 lymphocytic infiltration of primary tumour.

Fig. 8.—Grade 3 follicular reaction of perigastric lymph node.

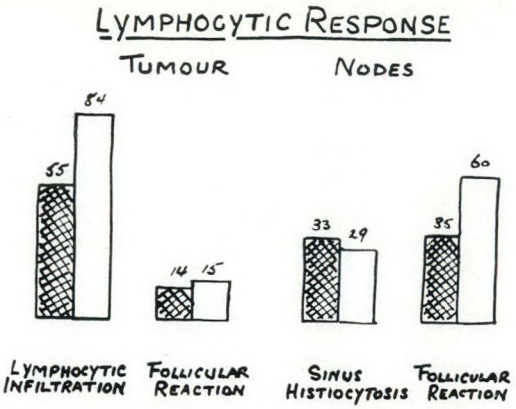

Fig. 9.—Comparison of lymphocytic response of primary tumour and perigastric lymph nodes in short-term survivor (shaded areas) and long-term survivor (clear areas) groups. Figures denote the sum of activity, graded from 0-4, of all cases with respect to each process.

compared to the short-term survivors, 55 and 35 respectively (Fig. 9). There was no real difference in the follicular reaction of the stomachs of the long-term and short-term survivors, 15 and 14 respectively, or of sinus histiocytosis in the perigastric lymph nodes, 29 and 33 respectively.

Summary

Clinical and pathological features of 36 persons who survived five or more years following gastric resection for carcinoma of the stomach are compared with similar features in an equal number of selected persons who succumbed in less than four years under similar circumstances.

Women had a greater natural resistance than men to the progress of this disease.

The duration of symptomatology was significantly longer in the short-term than in the long-term survivor group.

The presence of abdominal tenderness and the discovery of an abdominal mass was twice as common in the short-term as in the long-term survivors. Polypoid growths predisposed to long-term survival and infiltrating growth to short-term survival.

The production of excessive mucoid material by the cancer cell was a bad prognostic sign.

Gastric cancers arising in pre-existing benign peptic ulcers were associated with a poor prognosis.

Whereas tumour extension to the perigastric lymph nodes and gastric serosal penetration by the primary growth were more common in the short-term survival group, these features should not preclude attempts at complete surgical ablation since they were present in 40% and 27%, respectively, of the long-term survivor group.

There was a significantly increased lymphocytic response in the long-term survivor group as evidenced by increased diffuse lymphocytic infiltration of the stomach wall and increased follicular hyperplasia in the regional lymph nodes.

Acknowledgments

I am grateful to Dr. L. T. Maxwell for his assistance in gathering material and to Dr. H. K. Fidler for the histological interpretation of lymphocytic response and tumour grading.

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Résumé

Dans cet article, l'auteur étudie 36 cas de malades survivant au moins cinq ans à une résection gastrique pour cancer, comparativement à un groupe de même importance n'ayant pas présenté une survie de plus de cinq ans. Il ressort de là que les femmes offrent une plus grande résistance au progrès de la maladie que les hommes. L'apparition des symptômes remontait à beaucoup plus longtemps chez ceux qui survécurent le moins. La découverte de masses intra-abdominales ne signifie pas grand chose. Sont de mauvais pronostic les faits suivants: une croissance tumorale par infiltration; l'hyperproduction de substances mucoïdes; les carcinomes apparaissant sur un ulcère peptique primitivement bénin. L'envahissement des ganglions lymphatiques et l'infiltration de la séreuse gastrique sont un mauvais signe, mais ceci peut être modifié par l'importance de la résection. L'infiltration lymphocytaire diffuse de la paroi gastrique et l'hyperplasie folliculaire des ganglions régionaux correspondent aux cas à longue survie.

A NEW TECHNIQUE IN THE DIAGNOSIS OF HIRSCHSPRUNG'S DISEASE*

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HIRSCHSPRUNG'S disease may be defined on a histopathological basis as a congenital absence of the myenteric nerve plexuses extending from the anus for a variable distance proximally; the majority do not extend proximal to the sigmoid colon.

Although this disease was not unknown before his time, it was Hirschsprung[8] who described in 1888, the postmortem findings in two cases, noting that "when the abdomen was opened, two enormously dilated loops of large intestine presented themselves — the sigmoid and the even more severely distended transverse colon. Also, the other part of the large intestine appeared somewhat dilated; only the rectum was not enlarged, but rather seemed to be the site of some kind of slight narrowing".

In January 1898, Treves[16] reviewed the literature on idiopathic dilatation of the colon and described a typical case of Hirschsprung's disease in which he performed a colostomy and later removed the descending colon, sigmoid colon and most of the rectum.

Unfortunately, for many years, the pathogenesis of this disorder was sought in the distended bowel segment.

The history of the final evaluation of the pathology of Hirschsprung's disease is interesting. Intensive medical measures, spinal anesthesia and sympathectomy and partial or total colectomy were among the various forms of treatment employed. In August 1948, Swenson and Bill[12] reported a new method of treatment by resection of the lower rectal segment and as much of the affected bowel as might be necessary, with preservation of the sphincters. This procedure constituted a major advance in the treatment of this disease. It is often erroneously stated that Swenson was the first to concentrate upon the narrow and apparently normal distal segment, but Tittel[15] in 1901, Cameron[3] in 1928, and Robertson and Kernohan[11] in 1938, all claimed to have demonstrated scantiness, degeneration or absence of ganglion cells in the bowel wall.

Dalla Valle[4] in 1920 reported the finding of megacolon in two siblings, with absence of ganglion cells in the sigmoid colon and normal ganglia in the proximal bowel.

Tiffin *et al.*[14] in 1940, and Zuelzer and Wilson[17] in 1948, reported aplasia of ganglion cells of the myenteric plexus in the distal bowel segment.

Finally, Bodian, Stephens and Ward[1] clarified the various types of megacolon in such a way as to make intelligent selective treatment possible.

It is convenient, when discussing the clinical features of Hirschsprung's disease, to recognize two types. The first is that form which presents in the neonatal period, and the second, that which is encountered in the older infant or child.

To consider the latter group first, it must clearly be understood that the anomaly is congenital, and that on careful questioning it is always possible to elicit a history of bowel trouble, however insignificant, since birth. Usually the initial neonatal symptoms may be so minor or so transitory that hospitalization is not necessary: even medical advice from the practitioner may not be sought. Following the early episode of obstipation and/or abdominal distension and vomiting, there may be a relatively asymptomatic period lasting weeks or months until the infant is in need of occasional aperients, suppositories or washouts. Interspersed with this benign course, at any time, attacks of vomiting, abdominal distension, fever and diarrhea may occur. These constitute a serious complication and are usually loosely designated as "enterocolitis".

The severity of the symptoms is as a rule, with certain noteworthy exceptions, directly related to the length of the aganglionic segment.

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*Presented at Congress of South African Association of Surgeons, Durban, September 1960.

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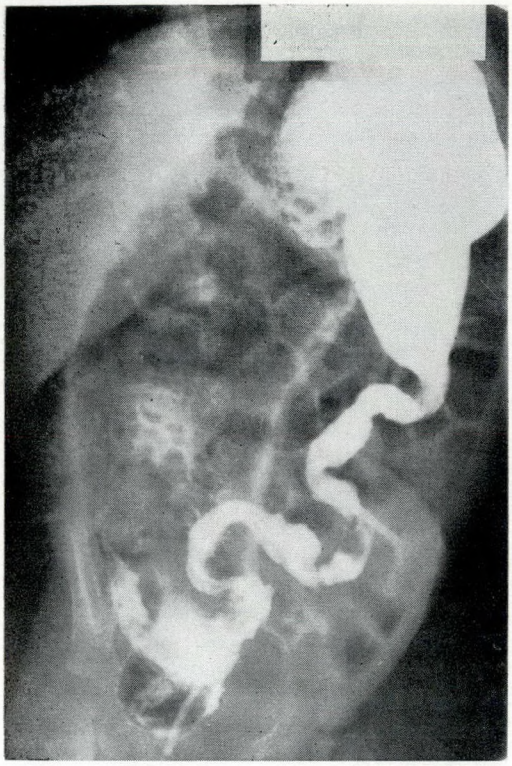

Fig. 1.—Radiograph showing typical barium enema findings in a patient with long-segment Hirschsprung's disease.

Examination usually reveals an undersized child with a distended abdomen and an empty rectum.

The other group of patients present with symptoms of Hirschsprung's disease in the neonatal period, usually within a week of birth, with bile-stained vomiting, abdominal distension and constipation — all the features of a low small intestinal or large intestinal obstruction. It is often impossible in such cases to determine the nature of the obstruction on clinical grounds, and in these circumstances radiological investigation is obligatory. Unfortunately, in the neonatal infant it is impossible to distinguish dilated ileum from dilated colon, so that in every case in which the diagnosis of Hirschsprung's disease is entertained, an opaque enema must be performed before a bowel washout or any other preparation of the bowel is attempted.

In a typical case, a barium enema will clearly demonstrate the distal narrow, aganglionic segment (Fig. 1); the cone or funnel proximal to this segment, and the dilated, hypertrophied bowel yet further proximally. The diagnosis in such a case presents little difficulty. A delay of 24 hours or more in eliminating the contrast material also favours the diagnosis.[5]

Diagnostic difficulties are encountered, however, in those with short-segment Hirschsprung's disease in which the dilatation extends distally to involve the rectum. In such cases, additional diagnostic procedures are necessary to distinguish true Hirschsprung's disease from acquired megacolon or colonic inertia (Fig. 2).

In infants, too, radiological study is less satisfactory than in the older child as the characteristic changes take time to develop.

The diagnosis can be established by rectal biopsy. Adequate microscopic sections of the rectal wall in Hirschsprung's disease reveal the characteristic absence of ganglion cells in the myenteric plexus.[2]

The biopsy technique described by Swenson[13] involves removal of a 5 mm. x 10 mm. full-thickness section of the rectal wall and repair of the wall and mucosa

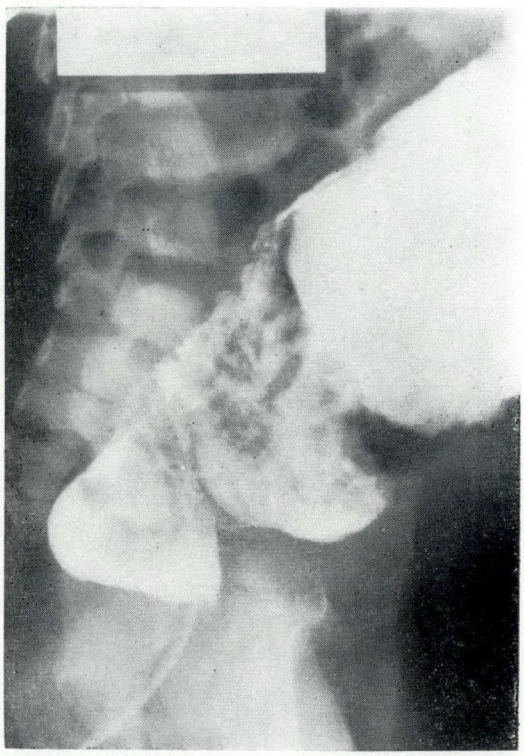

Fig. 2.—Short-segment Hirschsprung's disease.

with two layers of interrupted sutures. This procedure is carried out under general anesthesia, operating through a bivalve speculum, the lower end of the incision being 3 cm. from the mucocutaneous junction. The specimen so obtained is examined microscopically and a search is made for ganglion cells in the intermuscular nerve plexuses. The presence of ganglion cells in such a biopsy rules out a diagnosis of Hirschsprung's disease.

According to Bodian,[2] the diagnosis of Hirschsprung's disease can be made by examination of a biopsy of mucosa and submucosa only, by searching for ganglion cells in the submucous nerve plexuses. This submucous biopsy is carried out under general anesthesia and the mucosa is sutured, leaving a drain *in situ*. It does not involve excision of any portion of the muscular wall.

A third biopsy technique, described by Hiatt,[7] involves an approach to the posterior rectal wall through an incision in the natal cleft midway between the anus and the coccyx. The biopsy specimen is obtained without entering the bowel lumen, thus avoiding contamination by rectal contents. General anesthesia is required for this procedure.

The fact that such a selection of biopsy techniques exists, in itself suggests that a completely satisfactory procedure has not yet been devised. Experience in the pathology department of the Red Cross Children's Hospital in Cape Town, indicates that it is difficult or at times impossible to base any sound conclusions on the micro-

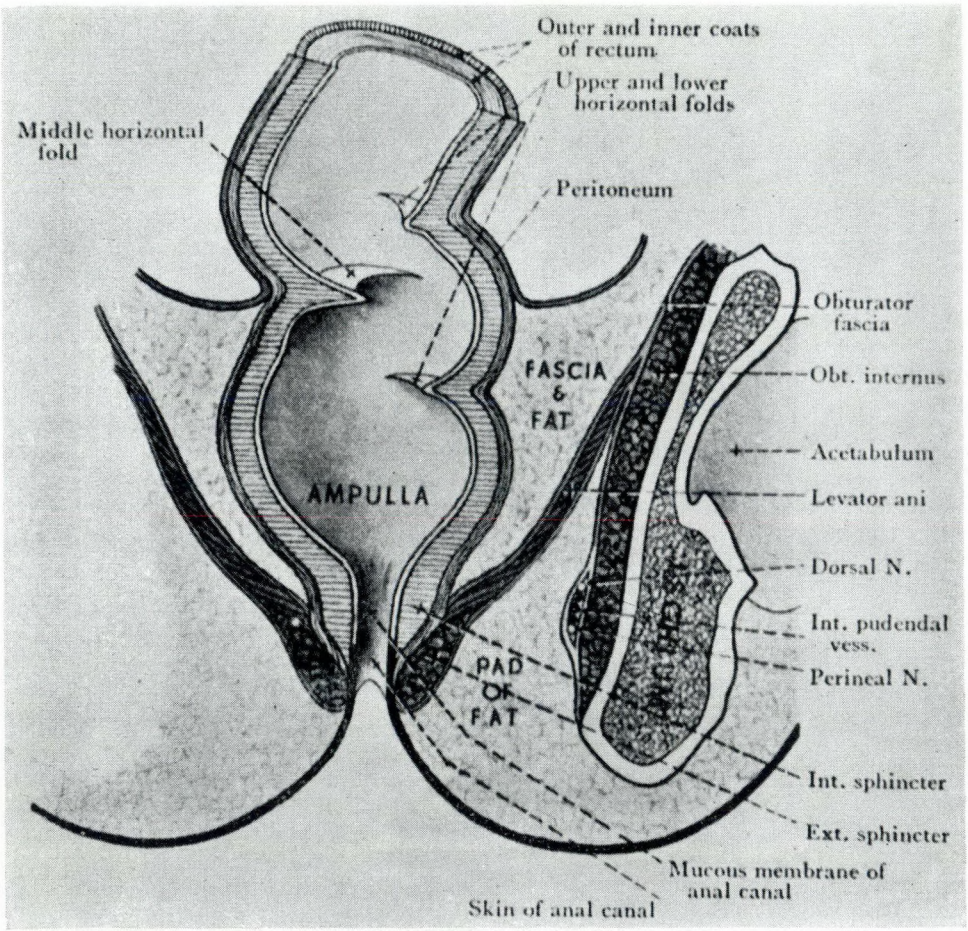

Fig. 3.—Diagrammatic coronal section through pelvis indicating the valves of Houston which consist of mucosa and muscle. (Reproduced from Jamieson's Atlas of Anatomy by kind permission of the publishers, E. & S. Livingstone Ltd., Edinburgh.

scopic findings in submucous biopsy specimens obtained by the technique described by Bodian.

The biopsy procedures described by Swenson and Hiatt are by no means innocent operations without ill effects, and in our experience have, at times, been followed by serious rectal bleeding, sepsis and perirectal or retrorectal fibrosis. The latter greatly interferes with subsequent operations in the region of the anal canal and rectum. These undesirable features of the existing methods prompted a search for a more satisfactory biopsy technique.

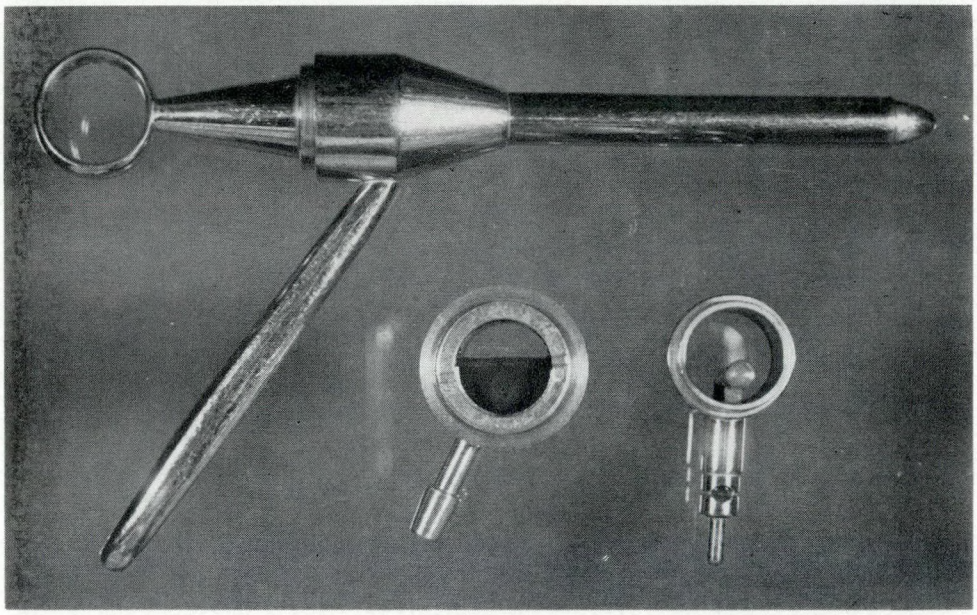

Fig. 4a

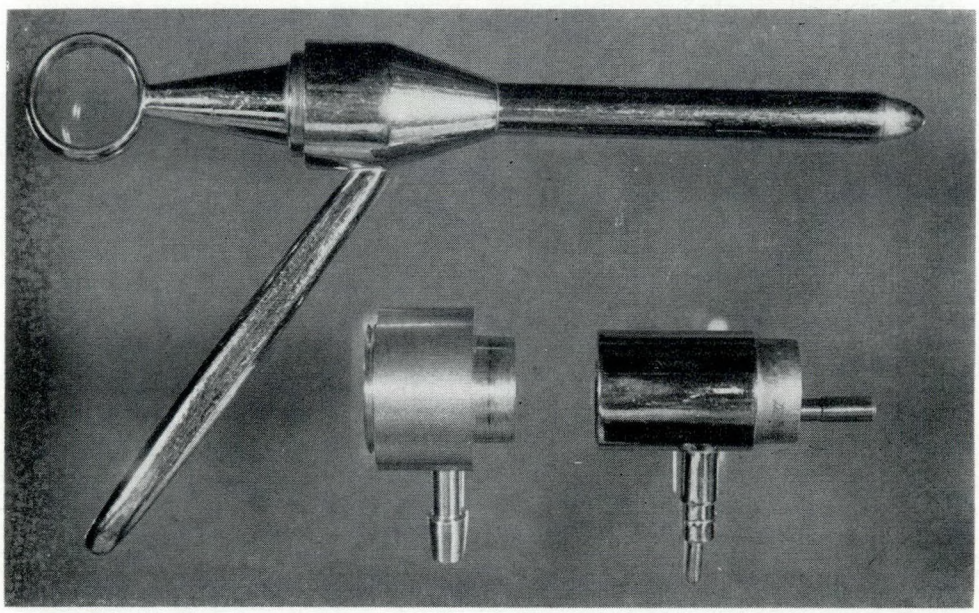

Fig. 4b

Figs. 4a and b.—Infant sigmoidoscope with light carrier and eyepiece with renewable rubber washer.

The three transverse folds or valves in the rectum, originally described by Houston,[9] are illustrated in Fig. 3, with the lowest and highest on the left side, and the middle one on the right. Occasionally a fourth valve is present. In adults, the lowest valve of Houston is about 5 cm. from the mucocutaneous junction; in children this distance varies from approximately 1 cm. to 3 cm. depending on the age of the child. According to Gabriel[6] the curves of the rectum are accentuated on their concave aspects by infoldings of the whole thickness of the rectal wall which constitute the rectal valves of Houston. Hughes[10] also maintains that the valves of Houston contain extensions from both muscle coats and fibrous connective tissue, an observation that is confirmed in many textbooks of anatomy and rectal surgery. Houston[9] himself described the presence of circular muscle fibres in these valves.

Consideration therefore was given to the feasibility of obtaining a suitable biopsy specimen from one of the valves, which would include sections of mucosa and muscle tissue. Such a procedure should involve minimal trauma, little or no risk of perforation of the rectal wall and should be performed on patients of all ages, without the use of general anesthesia. The biopsy specimens so obtained should be adequate to demonstrate the absence of ganglion cells, of diagnostic significance in patients with Hirschsprung's disease.

After considerable investigation on a trial-and-error basis, it was concluded that optimum sedation for this procedure was provided by a combination of Seconal sodium,® gr. ¾ per stone (14 lb.) of body weight and chlorpromazine hydrochloride, 2mg./lb., administered orally, one and one-half to two hours before the operation.

Additional clinical trials led to the conclusion that the most effective means of rectal cleaning in preparation for this biopsy procedure is accomplished by the insertion of one Dulcolax® suppository in the rectum, one hour preoperatively, the patient emptying his bowel before the operation.

After such preparation and under sedation, the patient, who is usually in a deep sleep, is placed on the operating table in a prone, jack-knife position. Final rectal cleaning is facilitated by suction with a bronchoscope sucker. Any of the child sigmoidoscopes can be used (Figs. 4a and b); but at the Red Cross Children's Hospital, Cape Town, the Lloyd-Davies infant sigmoidoscope with proximal lighting is considered preferable for this procedure in children of any age. After insufflation of the rectum the folds of Houston stand out prominently but on removal of the eyepiece of the sigmoidoscope to permit insertion of the biopsy forceps, the rectum collapses and the folds are not readily recognizable. To overcome this difficulty a special eyepiece was designed for the sigmoidoscope, incorporating a renewable rubber washer which prevents the escape of air when the biopsy forceps is inserted, and permits the performance of biopsy while rectal insufflation is maintained. If such an eyepiece is not available the shelf-like fold of the rectal valve to be biopsied can be maintained as a prominent projection into the lumen by packing a swab beneath it.

It was found to be advisable to remove three specimens from the valve to provide adequate biopsy sections. Some bleeding may occur but this is usually minimal and requires no special care.

The size of the biopsy specimen is important. If the "bite" is too small it will remove mucosa only, especially if the valve is not standing out prominently when the section is taken. It should be possible to demonstrate the definite presence or absence of ganglia in every case, provided the amount of biopsy material removed is adequate (Figs. 5a and b). Three sections should be cut from each tissue fragment, thus tripling the total biopsy area available for microscopic examination.

This method of rectal biopsy was performed on 40 patients of whom eight were children or newborn infants with Hirschsprung's disease. The diagnosis was confirmed by histopathological study of surgical excised portions of bowel in all but one of the latter group; the remaining patient presented typical clinical and radiological features of Hirschsprung's disease but was not subjected to operation. Biopsies were performed by this technique on 32 children

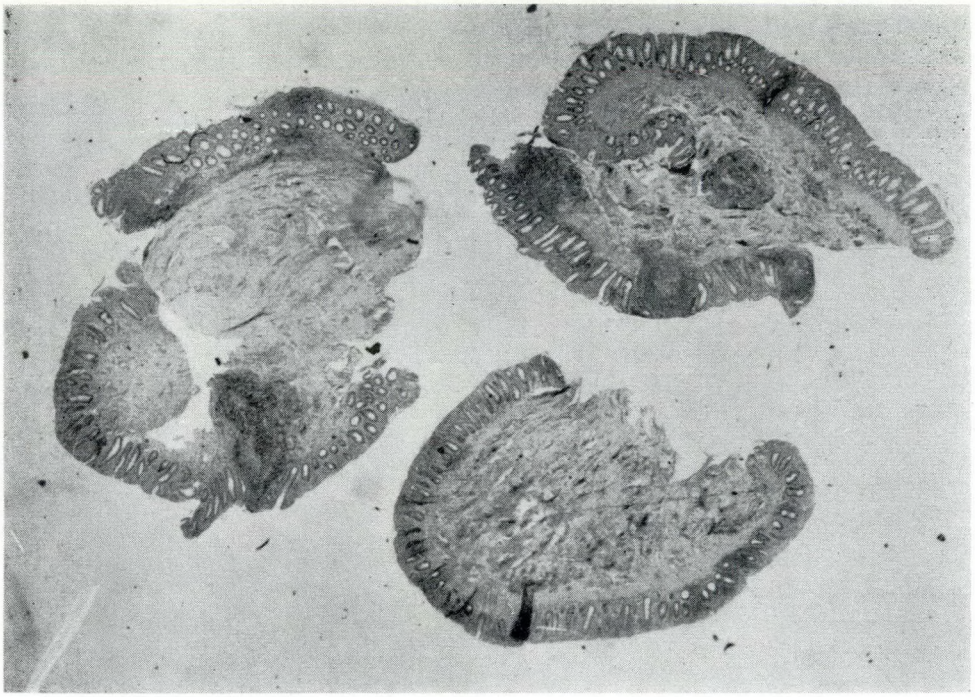

Fig. 5a

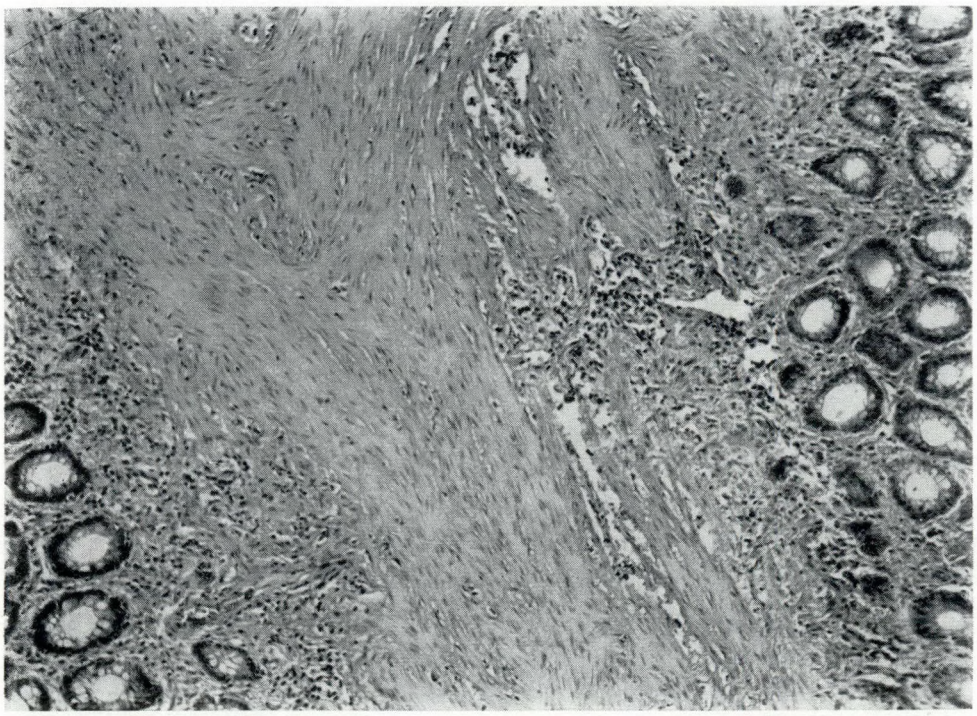

Fig. 5b

Figs. 5a and b.—(a) Material obtained by biopsy of Houston's valve (original magnification x 35). (b) High-power view showing membrane with muscle between (original magnification x 150).

with burns, osteitis, herniae and other unrelated disorders, as a control group. In the latter group, ganglion cells were seen in every case in which an adequate biopsy specimen was taken. No ganglion cells were observed in one specimen that consisted almost entirely of mucosa, but repeat biopsy on the same patient revealed the presence of normal ganglion cells.

The obvious importance of rectal biopsy in the diagnosis of Hirschsprung's disease was emphasized by one case in particular. This patient was a boy who presented typical clinical and radiological features of this disorder (Fig. 6), and who had a sister with a proven diagnosis of Hirschsprung's disease. Under these circumstances rectal biopsy was considered unnecessary to establish the diagnosis but this procedure was carried out nevertheless, and to the surprise of all concerned, the specimen revealed the presence of ganglion cells in the rectal wall. Subsequent examination of the colon and rectum confirmed the fact that this patient did not have Hirschsprung's disease.

Fig. 6.—Barium enema radiograph of patient with a clinical syndrome resembling Hirschsprung's disease.

Summary

The pathology and clinical types of Hirschsprung's disease (congenital megacolon) are discussed and the diagnostic criteria are considered from the clinical, radiological and histological points of view.

The most conclusive criterion for diagnosis to date is the demonstration of complete absence of ganglion cells in the submucosal and intermuscular nerve plexuses of the distal colon and rectum.

Disadvantages of previously described techniques of rectal biopsy are discussed and a new simplified method for obtaining biopsy material from Houston's valves is described.

This technique does not require general anesthesia, does not involve incision of the rectum or suture of the mucosa, does not result in sequelae that interfere with a subsequent Swenson or Duhamel operation, and has not been complicated by hemorrhage, sepsis or fibrosis.

In a series of 40 biopsies using this technique, ganglion cells were demonstrable in every child who did not suffer from Hirschsprung's disease, and were absent in every patient with an established diagnosis of this disease.

Adequate biopsy of a valve of Houston can provide unequivocal evidence of the presence or absence of Hirschsprung's disease.

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Résumé

La maladie de Hirschsprung peut être définie comme étant une absence congénitale des plexus nerveux myentériques, depuis l'anus en remontant vers le haut du tube digestif; toutefois, dans la majorité des cas, cette absence ne dépasse pas le côlon sigmoïde. C'est ainsi que se forme le syndrome du megacôlon.

Après avoir passé en revue la littérature sur ce sujet, l'auteur aborde le problème du diagnostic. Le critère le plus certain pour confirmer une maladie de Hirschsprung est évidemment la constatation sur coupes histologiques de l'absence complète de cellules nerveuses ganglionnaires dans la sous-muqueuse et entre les faisceaux musculaires lisses de l'intestin. Il a donc été préconisé de pratiquer des biopsies de la paroi rectale. Cette technique a cependant des désavantages et des inconvénients qui sont discutés en détail.

L'auteur propose une nouvelle méthode. Il préconise à cette fin d'utiliser les valvules rectales en lieu et place de la muqueuse rectale proprement dite; ceci a l'avantage de permettre l'obtention biopsique facile de fragments contenant de la sous-muqueuse et de la musculaire. Toute anesthésie générale devient inutile, de même que toute incision et toute suture. Cette technique a déjà été employée chez 40 malades avec des résultats satisfaisants.

En conclusion, il semble que la biopsie d'une des valvules de Houston permette un diagnostic précis et aisé de la maladie de Hirschsprung.

QUALITIES NEEDED BY THE SURGEON*

Those special abilities which are needed above all others by the successful surgeon, have been detailed excellently by the English physician Hutchinson, in a talk to students of the London Hospital Medical College. He called them the "seven presents which heaven should give to a future surgeon."

First of all, the surgeon must have a sound and healthy constitution, one which is able to resist fatigue and contagion.

Second, the surgeon needs good fortune to attend his efforts. This gift is rare enough, and when it is lacking, hard work and patience may compensate for what is absent.

Third would be intelligence, but not too much of it. Intelligence needs to be tempered to a certain degree by great zeal.

Fourth is a considerable endowment of equanimity, which will enable the surgeon to master difficult situations and withstand the onerous burdens of daily troubles and problems.

Fifth, Hutchinson proposes a sense of justice toward patients as well as toward the surgeon's staff and toward himself.

Sixth, he mentions an appreciation of beauty; since any disease is a contradiction of beauty, the surgeon ought to be able to observe, recognize and enjoy beauty outside his everyday hospital work.

Finally, the surgeon should be a man of much good humor. Good humor will support him in withstanding extravagant demands not only on the part of his patients but also on the part of their relatives. A few words of good humor often will help more than psychotherapeutic efforts.

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THE SURGERY OF THE THORACIC INLET*

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THE THORAX is bounded by the thoracic inlet above, and the diaphragm below. Over the past 25 years the lower boundary, the diaphragm, has presented no serious surgical barrier between the abdomen and the thorax. As Sir Heneage Ogilvie, that coiner of apt phrases, has so well put it, "the iron curtain of the diaphragm" no longer exists. At the other end of the thorax, the thoracic inlet has proved a somewhat more difficult problem. This is because of its small size, bounded as it is by the upper thoracic vertebrae, the first rib, the clavicle and the manubrium sterni. Access is therefore limited. Through it go certain important structures which may be of concern to the surgeon, such as the trachea and esophagus, the subclavian vessels, the carotid vessels, the sympathetic chain, the first thoracic nerve, and the thoracic duct. Furthermore, the roots, trunks and the divisions of the brachial plexus enter into this field. Pathologic entities which may call for thoracic inlet exploration may be found in connection with the thyroid gland, for example a retrosternal goitre, and with the parathyroid glands, in the form of a parathyroid adenoma. Cervical rib, osseous or fibrous, may involve the brachial plexus. Aneurysms or obliterative disease of the subclavian, carotid and vertebral arteries may necessitate exploration of this area. Cystic hygroma may spread through the thoracic inlet. Tumours may develop on the first thoracic nerve. Enlargement of the upper mediastinal lymph nodes may occur due to a variety of causes and these can be reached from the neck via the thoracic inlet.

The anatomy and surgical approaches to this area are probably less familiar to surgeons than is the case with the lower thoracic outlet. Therefore, it appears useful to review the surgical approach to this area. To reach midline or near midline structures situated anteriorly, the sternum splitting incision is useful and in these days of openheart surgery this approach is being widely used. For more laterally placed structures, however, and particularly in the approach to the lower half of the brachial plexus and the sympathetic chain, the supraclavicular approach of Telford is to be preferred. It is perfectly feasible to divide the clavicle and thus open up the area somewhat, but this should rarely be indicated inasmuch as this bone lies in a plane anterior to the first rib, and it is the restricting curve of the first rib which so often provides the difficulty of access.

Of recent years the author has had occasion to explore the thoracic inlet for a wide variety of conditions, some of which are set out as follows.

1. Lesions requiring cervico-dorsal sympathectomy:
   (a) Raynaud's disease
   (b) Hyperhidrosis
   (c) Angina pectoris
   (d) Disciform macular degeneration of the retina.
2. Neurofibroma of the first thoracic nerve.
3. Cervical rib, both osseous and fibrous, causing pressure on the lower brachial plexus.
4. Aberrant phrenic nerve causing compression of the subclavian vein.
5. Cystic hygroma.
6. Aneurysms of the first and second intercostal arteries.
7. Axillary artery aneurysm requiring proximal control.

The key to understanding of the anatomy and exploration of this area is provided by the anterior approach to the cervico-dorsal sympathetic chain. This was described in detail by the author in 1957,[1] and the reader is referred to this article for a detailed description of the technique involved. Perhaps in no area of the body is minute attention to detail more important, in order to provide a clear and adequate

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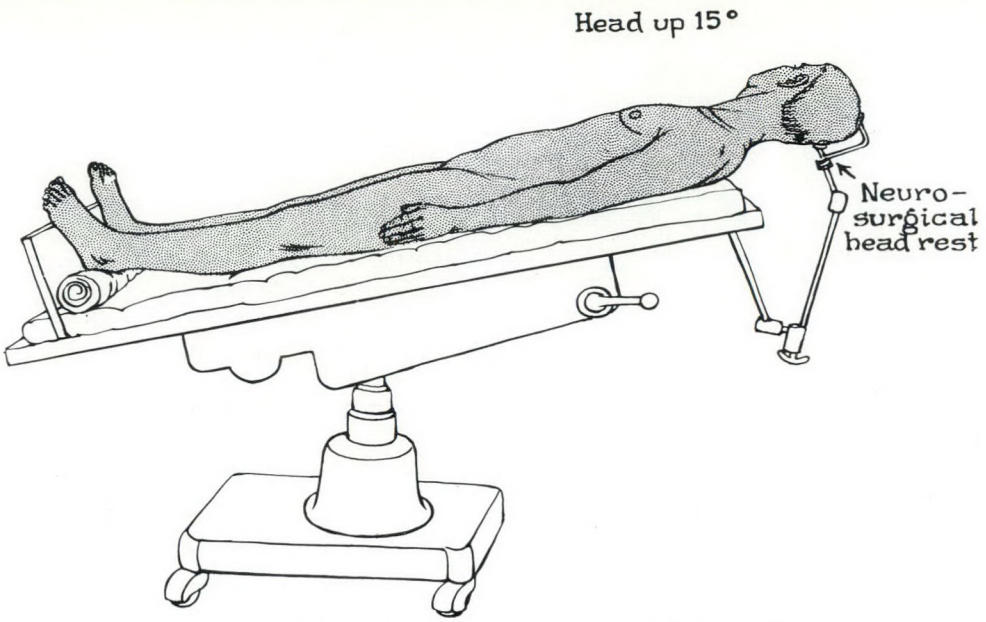

Fig. 1.—Position of patient for exploration of thoracic inlet.

exposure. The technique of the exposure is illustrated in Figs. 1, 2, 3 and 4.

The Following Special Points Should be Observed

1. The patient should be carefully positioned on the operating table (Fig. 1). The table is tilted, head up, about 10° because this decreases venous congestion. The head is turned to the opposite side, and the shoulder and arm are pulled well down and fixed thus to depress the clavicle out of the field.
2. The incision is short, not more than three inches in length, and is sited over the clavicular head of the sternomastoid muscle. It is unwise to incise lateral to this muscle, because a mass of fat and a friable plexus of supraclavicular veins are thereby exposed in the supraclavicular fossa (Fig. 2).
3. The clavicular head of the sternomastoid muscle is divided close to the clavicle by first passing a right-angled hemostat beneath it, and elevating the muscle, before it is divided with a scalpel (Fig. 3).
4. The internal jugular vein is retracted medially and at this stage the position of the scalenus anticus muscle is felt as a taut, broad band. The areolar tissue overlying the muscle is stroked aside by a small gauze sponge and thus the phrenic nerve is located. The nerve is dissected free from the fascia of the muscle and is retracted medially (Fig. 4).
5. The scalenus anticus muscle is isolated by carefully passing a right-angled hemostat beneath it. It is then divided by a scalpel. This should be done cautiously because a very short branch of the subclavian artery may enter the deep surface of the muscle. This vessel is easily torn away from the subclavian artery causing undesirable arterial hemorrhage. The scalenus anticus muscle should always be divided in any exploration of the area because this maneuver greatly improves the exposure.
6. The subclavian artery is thus clearly exposed in its three parts. This vessel must be freed completely. This is facilitated by dividing the thyroid axis artery; care must be taken, however, not to divide the vertebral artery (Fig. 5).
7. Sibson's fascia is then divided by gently nibbling through it piecemeal, exposing the extrapleural fat. The pleura is then

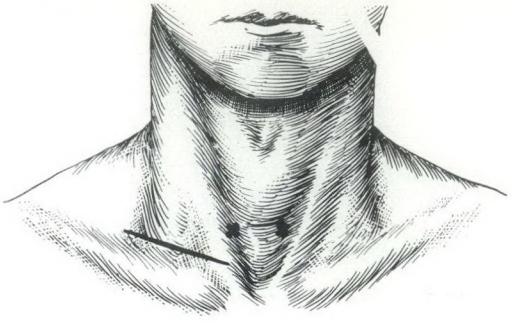

Fig. 2.—Site of incision for exploration of thoracic inlet or upper dorsal sympathectomy by the anterior route.

stroked down off the ribs and thoracic vertebral bodies by the index finger. This maneuver should be carried out in any full exploration of the area to improve the exposure and display the whole of the inner rim of the first rib (Fig. 5).

8. The sympathetic chain is then felt overlying the neck of the first rib. It is easier to locate the chain at first by touch rather than by sight. Further laterally the first thoracic nerve is both felt and seen (Fig. 6). Two other approaches to the cervico-dorsal sympathetic chair are available:
   (a) The posterior approach of Adson
   (b) The axillary approach of Atkins.[2]

However, the most universally applicable approach is the anterior one described above because it permits ample exposure of the upper dorsal sympathetic chain as far down as the fourth thoracic ganglion, as well as the stellate ganglion. In addition it permits a very thorough exploration of the thoracic inlet so that any unsuspected lesion such as a fibrous cervical rib will not be overlooked. This particular approach was used in operations on all of the conditions listed earlier. It would therefore be wise for surgeons to familiarize themselves with this anterior approach because of its wide applicability for a variety of conditions in addition to those requiring operations on the sympathetic chain.

It is not proposed to discuss the surgery of the sympathetic chain for Raynaud's disease as this has been described by many authors in a number of publications. Furthermore, the author has encountered

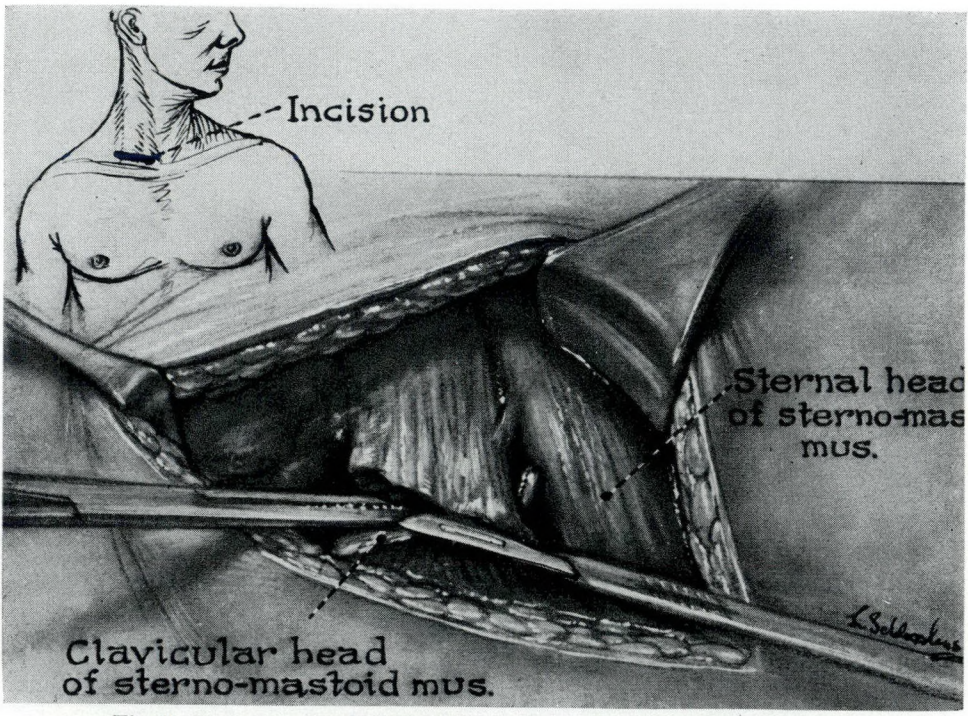

Fig. 3.—Technique for division of clavicular head of sternomastoid muscle.

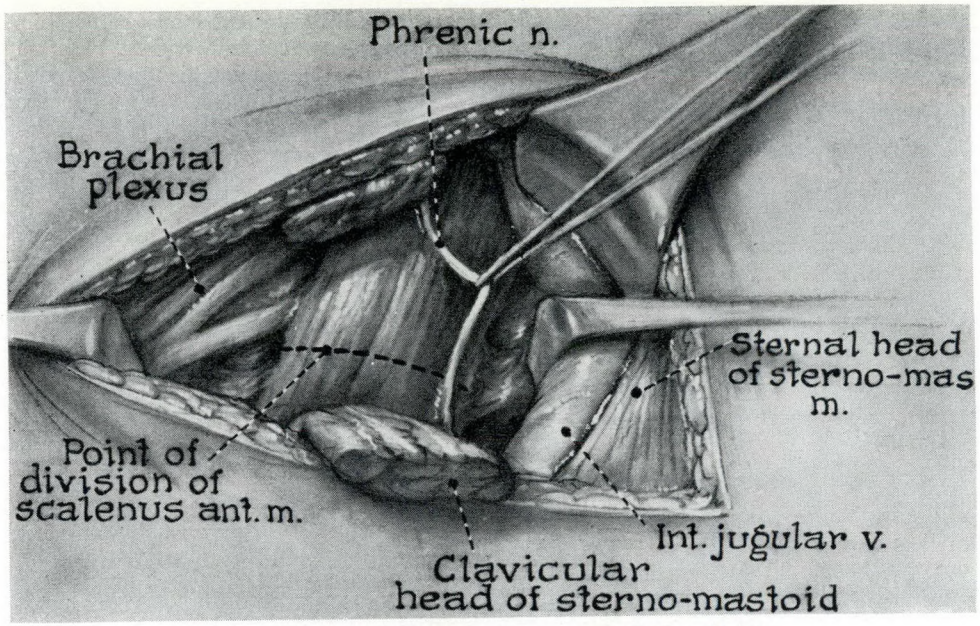

Fig. 4.—Display of scalenus anticus muscle before division.

relatively few patients with Raynaud's disease in Canada as compared with its frequency in Great Britain. It is interesting to speculate as to why this is so, since Canada has severe winters. One possible explanation lies in the universal use of central heating in Canada. Thus, Canadians are warm 90% of the time whereas the inhabitants of Great Britain are cold 90% of the time!

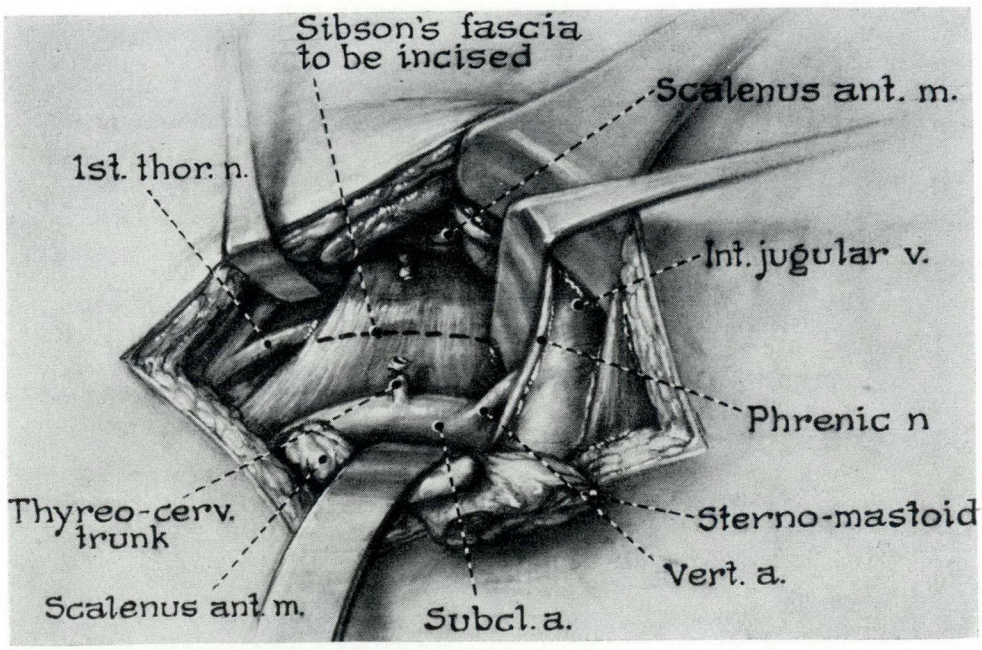

Fig. 5.—Extent of dissection after division of scalenus anticus muscle, showing the site of division of Sibson's fascia.

Hyperhidrosis

CASE 1.—Mrs. W., aged 31 years, had suffered from excessive sweating of her hands all her life. This was made worse by excitement. Her hands would frequently drip with perspiration and of late she had found it hard to drive her automobile because the steering wheel became so slippery due to this excessive sweating. She also suffered from eczema of her hands. Radiography revealed bilateral cervical ribs (Fig. 7) and it was considered that these possibly might be an initiating factor in producing the hyperhidrosis. It was also thought that the eczema might be improved by rendering her hands dry. Therefore bilateral excision of the cervical ribs was carried out together with removal of sympathetic ganglia T2 and T3. The stellate ganglion was carefully preserved. Following this operation her hands remained dry and she experienced no more sweating; the eczema however was not improved and indeed seemed somewhat worse. Now she has difficulty driving her automobile because her hands are so dry that they tend to slip on the steering wheel.

CASE 2.—Mrs. I.C., aged 39 years, had a history of excessive sweating of her hands and feet since birth. In 1944 she had a bilateral lumbar sympathectomy and a right upper dorsal sympathectomy which was carried out by the posterior approach. After this operation, however, the sweating of the left hand became more pronounced to the extent that perspiration would drip from the finger tips. In 1959 the author performed an upper dorsal sympathectomy from the anterior approach. The second, third and fourth thoracic ganglia and the lower stellate ganglion were excised. This produced a dry hand but also a Horner's syndrome.

Angina Pectoris

Upper dorsal sympathectomy was formerly used for the control of pain in angina pectoris. This procedure is now rarely indicated in view of the efficacy of revascularization procedures for the myocardium. However, in the following case the circumstances were such that it did seem to be indicated.

CASE 3.—Mr. A.C., aged 62 years (patient of Dr. J. C. Dundee), had had Charcot-Marie-Tooth atrophy for 17 years and an

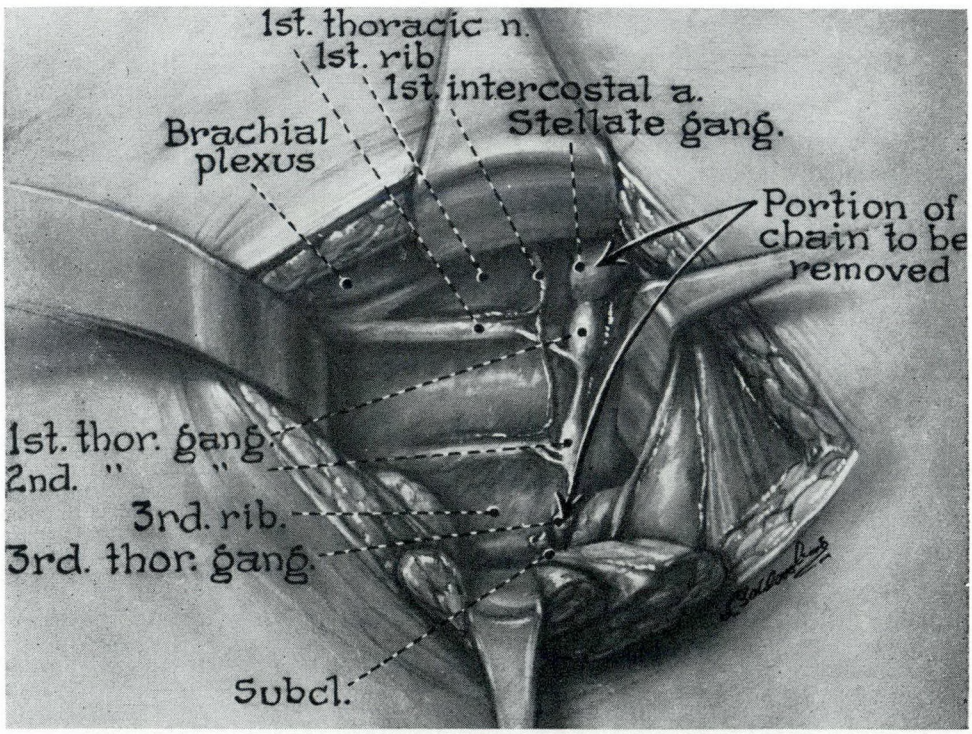

Fig. 6.—Display of the upper dorsal sympathetic chain and its relations, achieved by the anterior approach.

ulnar palsy of the right hand for 30 years due to an accident. He had had angina pectoris of increasing severity for the past 17 years. This had been much worse over the past three years during which he had six admissions to hospital and at the time of operation was in status anginosis. Therefore, a left upper dorsal sympathectomy was done with removal of ganglia T1—T4, and the stellate ganglion. In the postoperative period he developed posterior inferior cerebellar artery insufficiency and a further myocardial infarction, from all of which he recovered. He was relieved of his anginal pain in the precordium and down the left arm. He still had angina in his right arm, but it was bearable without narcotics. He died one year later due to myocardial infarction.

Had this man been in better condition, a further right upper dorsal sympathectomy would likely have relieved him of his angina on the right side. No direct cardiac surgery could be contemplated in this case, and therefore the pain-relieving operation of upper dorsal sympathectomy seemed to be indicated.

Disciform Macular Degeneration

Case 4.—Mr. C. (patient of Dr. S. Drance) had lost the central vision of his right eye from disciform macular degeneration due to vascular insufficiency. The left eye was beginning to develop a similar condition. Therefore, in the hope of increasing the blood supply to the left retina, a left stellate ganglionectomy was performed. Unfortunately, the desired increase of vascularity of the retina did not occur.

Neurofibroma of the Right First Thoracic Nerve

Case 5.—Mrs. L.B. (patient of Dr. L. McConnell), aged 19 years, had a routine chest radiograph which showed a round shadow in the right thoracic inlet area (Figs. 8 and 9). Her only symptoms were occasional weakness and numbness of the right forearm. Detailed radiographs showed erosion of the right pedicle of the 1st thoracic vertebra. A myelogram was normal. The right thoracic inlet was explored. A golf ball size tumour was found arising from the eighth cervical nerve. Frozen section showed it to be a neurofibroma. Therefore the capsule was incised and it was removed by morsellation. The eighth cervical nerve was sacrificed because it passed directly through the tumour. No neurological deficit resulted and the former slight symptoms were relieved.

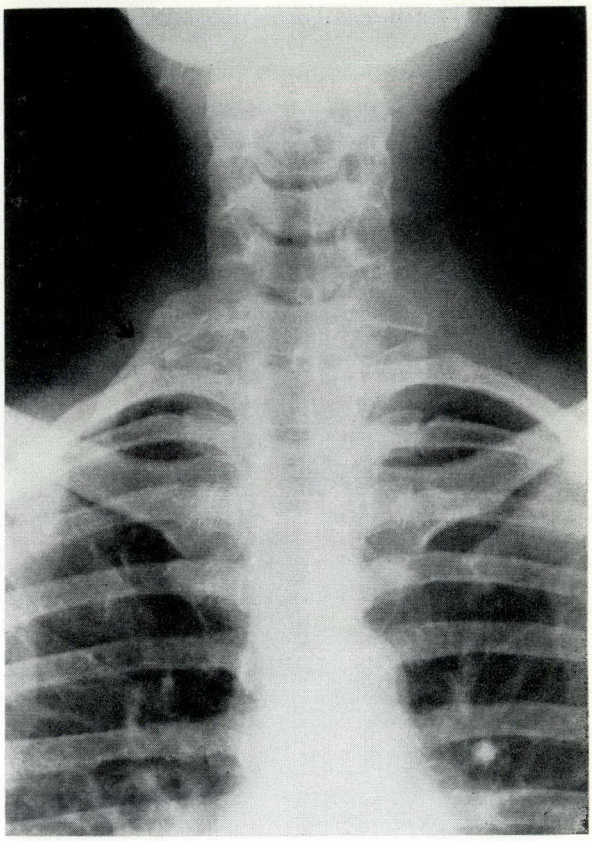

Fig. 7.—Mrs. W. Chest radiograph showing long cervical rib on right and rudimentary one of the left.

Cystic Hygroma

Case 6.—M.N., a girl aged two years and eight months, had a fluctuant lump the size of a plum in the left side of the neck, for one year. It was excised by the family doctor and was reported to be a semisolid cystic hygroma. It recurred in four weeks and further attempt at excision was made but because of severe bleeding the operation was abandoned. When seen by the author the child had an obvious fluctuant swelling in the left supraclavicular area, which increased in size on crying. A chest radiograph showed an extensive shadow in the left upper zone (Fig. 10). This, therefore, was an extensive cystic hygroma which extended down through the thoracic inlet into the upper mediastinum and left upper thorax. For this reason excision was performed in two stages. The first operation consisted of an exploration of the left thoracic inlet. This disclosed an extensive racemose lymphangioma infiltrating up the neck, across to the right side behind the esophagus and down through the thoracic inlet to the arch of the aorta. The

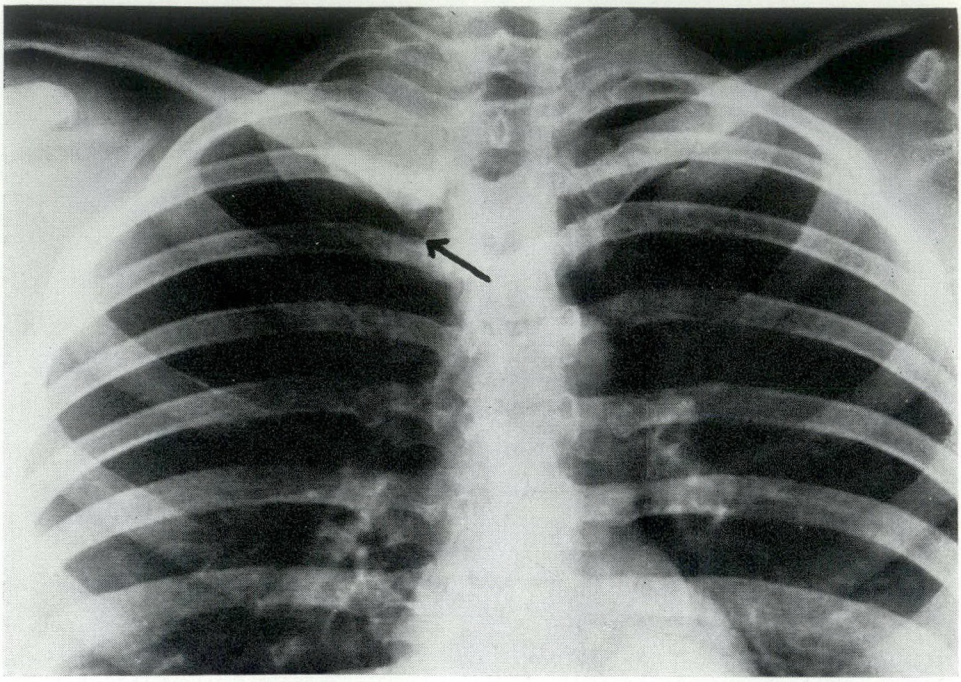

Fig. 8.—Mrs. L.B. Chest radiograph showing a round shadow in right thoracic inlet; antero-posterior view.

cervical portion of the lymphangioma was excised. In so doing the internal jugular vein was deliberately sacrificed and the thoracic duct was doubly ligated. The second operation was performed 12 days later via a left lateral thoracotomy. A semisolid, cystic, lobulated tumour, two inches by two inches in size was removed. It extended down to the hilum of the lung and ramified amongst the branches of the aorta and the innominate vein. This child's chest radiograph two and one-half years later is shown in Fig 11. Clinically the child is cured. This therefore represents a two-pronged attack upon the left thoracic inlet.

Aneurysms of the First Two Intercostal Arteries

Case 7.—Mr. J.S., aged 49 years (a patient of Dr. A. A. Bailey and Dr. R. B. Lynn), was previously reported upon in 1958.[3] The patient was admitted with a subarachnoid hemorrhage. All neurological examinations including carotid angiograms and myelography were unsuccessful in demonstrating the cause of the hemorrhage. The hemorrhage ceased. A chest radiograph revealed two round calcified lesions overlying the first and second intercostal spaces on the right side (Fig. 12). A diagnosis of aneurysms of the first and second intercostal arteries was made.

At the first operation by Doctor Lynn and the author, the chest was explored. Three aneurysms were found over the necks of the first, second and third ribs on the right side. A large feeding artery descended from above through the thoracic inlet. It could not be safely approached through the chest. Therefore, Doctor Lynn later performed a second operation in which he explored the right thoracic inlet from above and found a large internal jugular vein, 4 cm. in diameter, and a normal common carotid and right subclavian artery. There was, however, a large abnormal artery arising from the innominate artery. This abnormal artery arched up into the neck, then turned down through the thoracic inlet into the thorax to enter the first aneurysm. It was readily ligated. This, therefore, again represented a two-pronged attack on the inlet area.

Aberrant Phrenic Nerve Causing Compression of the Left Subclavian

Case 8.—Mrs. O.S. was 38 years of age (patient of Dr. J. Mowbray). Fifteen months before the patient was seen, she noted the sudden onset of numbness and blueness of the

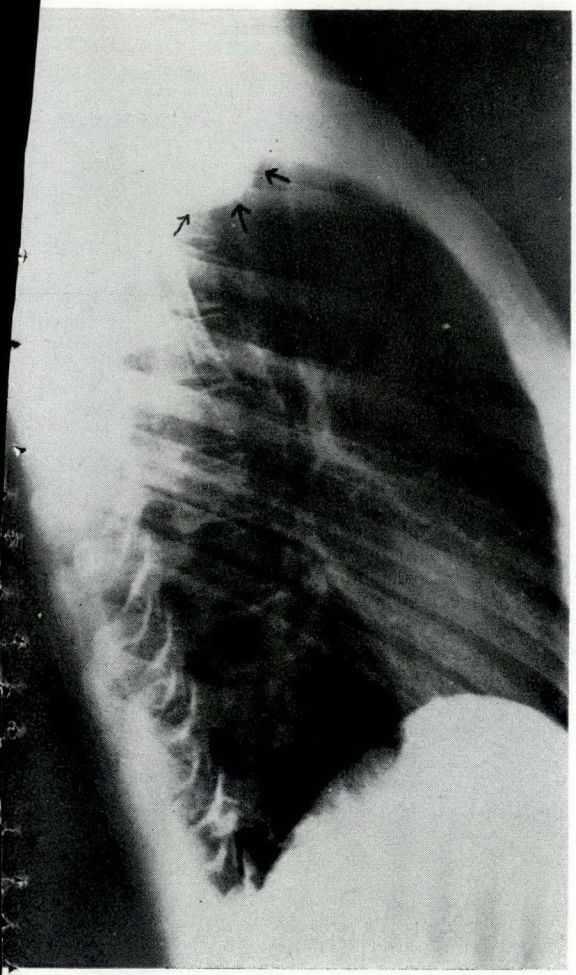

Fig. 9.—Mrs. L.B. Lateral radiograph of chest showing round lesion in right thoracic inlet area.

left arm. This lasted 15 minutes and then disappeared. This phenomenon recurred periodically over the next 15 months. It was initiated by such work as washing clothes, washing herself and scrubbing floors. The arm would swell, become tense, blue and painful. The superficial veins were dilated and prominent. The peripheral pulses were normal. A provisional diagnosis of axillary vein thrombosis was made but venograms showed no definite block and a cardiac catheter could be passed readily into the superior vena cava. She was observed for one further year but her symptoms of cyanosis, swelling and pain and paresthesias of ulnar distribution increased. The circumference of the left arm was 2 cm. greater than that of the right arm. The left thoracic inlet was explored and the branch of the fifth cervical nerve to the phrenic nerve was seen to hook around the subclavian vein, partially compressing it. This branch was divided because those from the third and fourth cervical nerves to the phrenic nerve were shown to be adequate for innervation of the diaphragm (Figs. 13 and 14). A fibrous cervical rib was also found and divided and an upper dorsal sympathectomy was performed. Following operation the patient's symptoms were relieved and the swelling in the arm disappeared.

Note.—This is an example of exploration of the thoracic inlet for a vague lesion, which demonstrated a rare anatomical abnormality.

Axillary Artery Aneurysm

CASE 9.—Mrs. D.B., aged 29 years, was accidently shot in the right axilla by her three-year-old son. This produced a traumatic aneurysm of the axillary artery. Before the aneurysm could be dealt with the subclavian artery had to be secured in its third part by a supraclavicular approach. The aneurysm was then excised.

Cervical Rib (Osseous or Fibrous) Producing Neurological Symptoms

Six patients with this type of lesion have been treated in the University of Saskatchewan Hospital. Two of these cases will be discussed.

CASE 10.—Mr. H.M., aged 49 years, (patient of Dr. J. G. Stratford), had a 20-year history of wasting of the hypothenar eminence and an eight-year history of deformity of the fingers and wasting of the forearm muscles. He had paresthesia of the medial two fingers. In other words, he had a typical ulnar nerve palsy. Radiography showed no suggestion of a cervical rib.

An exploration of the thoracic inlet revealed a classical fibrous cervical rib, over which passed a thickened edematous lower trunk of the brachial plexus. The fibrous band was divided. Six months later there was complete recovery of sensation in the medial half of the hand, and improved function of the forearm muscles.

CASE 11.—Mrs. M.C., aged 57 (patient of Dr. J. G. Stratford), was known to have radiological evidence of rudimentary bilateral cervical ribs. Twelve years previously she had had typical symptoms of irritation of the lower trunk of the right brachial plexus with pain, paresthesia and weakness of ulnar nerve

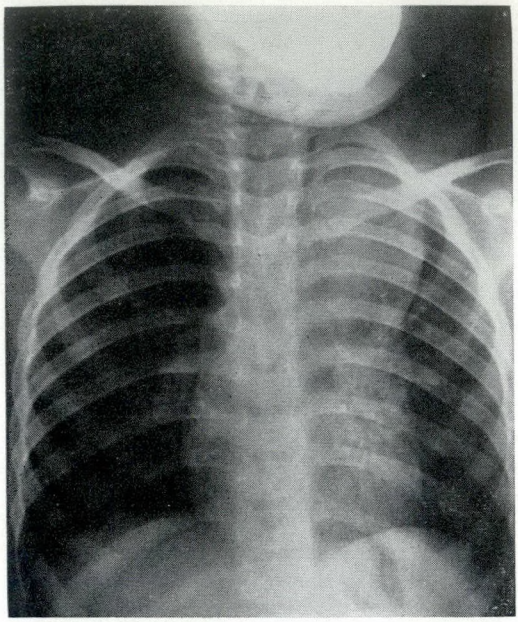

Fig. 10.—Miss M.N. Radiograph of chest showing large shadow in left upper zone.

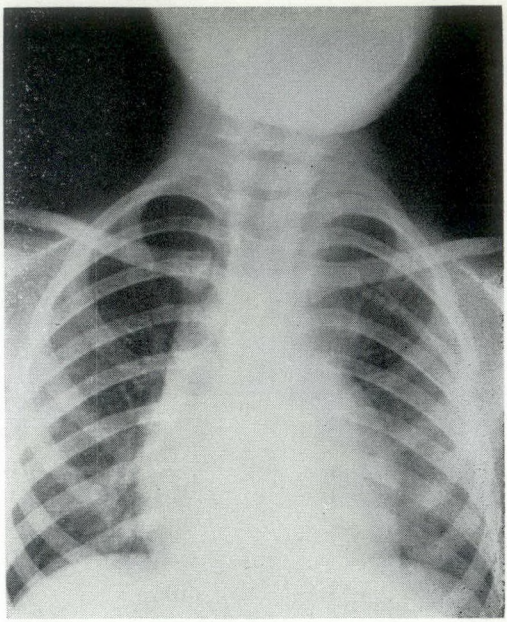

Fig. 11.—Miss M.N. Radiograph of chest taken two and one-half years after removal of extensive cystic hygroma of left side of neck and upper zone of left thoracic cavity.

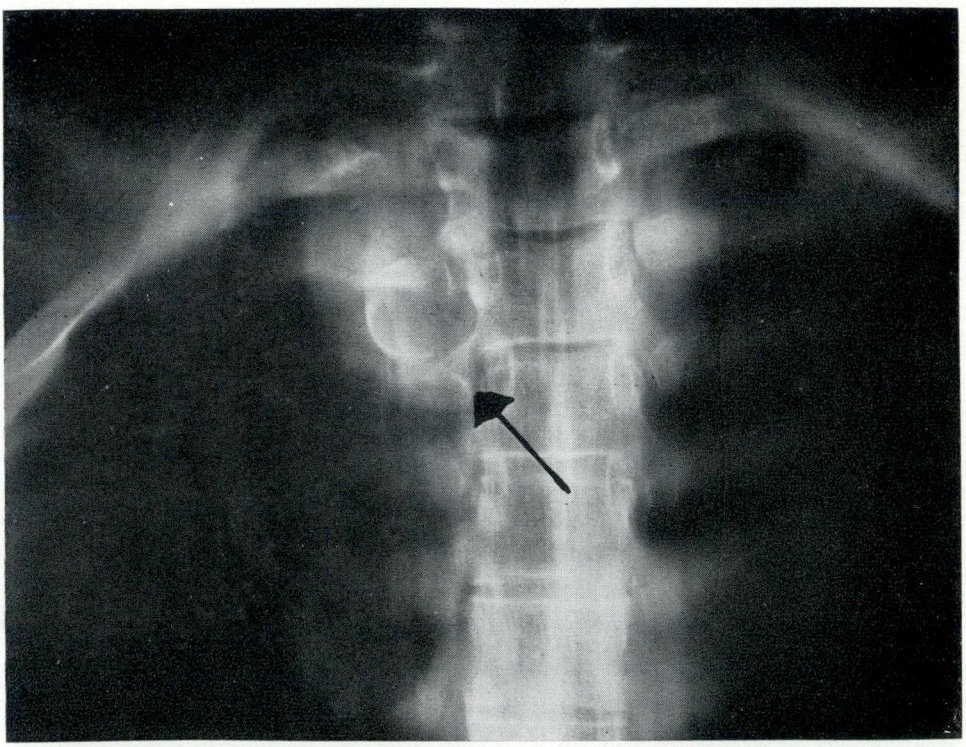

Fig. 12.—Mr. J.S. Planigram of right upper zone of chest at 9 cm. from the back, showing calcified intercostal aneurysm in second intercostal space.

distribution. At that time she had been explored by a neurosurgeon and had had a scalenotomy with relief. However, over the previous two years symptoms had recurred, and symptoms of lesser severity had developed on the left side.

Therefore, a re-exploration of the right thoracic inlet was undertaken. There had been a re-fusion of the scalenus anticus muscle by fibrous tissue which compressed the lower trunk of the brachial plexus against a fibrous cervical rib which extended up to a rudimentary osseous portion. The scalenus anticus muscle was again divided in the area of the fibrosis. The cervical rib was completely removed and the whole thoracic inlet area was explored. The subclavian artery was freed. This produced complete relief of symptoms. Ten days later the left side was similarly explored and treated with equally good results.

Note.—Some have claimed that scalenectomy is adequate treatment of such cases of cervical rib, a concept with which the author disagrees. The whole thoracic inlet should be explored and freed and the cervical rib should be completely removed. In carrying out this procedure the scalenus anticus muscle is of necessity divided as part of the exploration. There is no difficulty in removing a cervical rib without damage to the cervical plexus, provided that care is exercised. Furthermore, tense fibrous bands are often found in the scalenus medius muscle and these may be the cause of pressure on the lower trunk of the brachial plexus. They should be divided.

Summary and Conclusions

The anterior approach to the upper dorsal sympathetic chain has been described; the value of this approach in exploring the thoracic inlet has been demonstrated in a series of patients with a wide variety of lesions. An article such as this should illustrate certain morals, and advance certain pleas. The morals and pleas of this report are:

1) That surgeons should familiarize themselves with the anatomy of the thoracic inlet.
2) They should master the minutiae of the anterior surgical approach to the cervico-dorsal sympathetic chain, because this approach permits a thorough exploration of the thoracic inlet, with inspection of the subclavian vessels and the brachial plexus.

   This is not possible by the posterior or the axillary approaches.

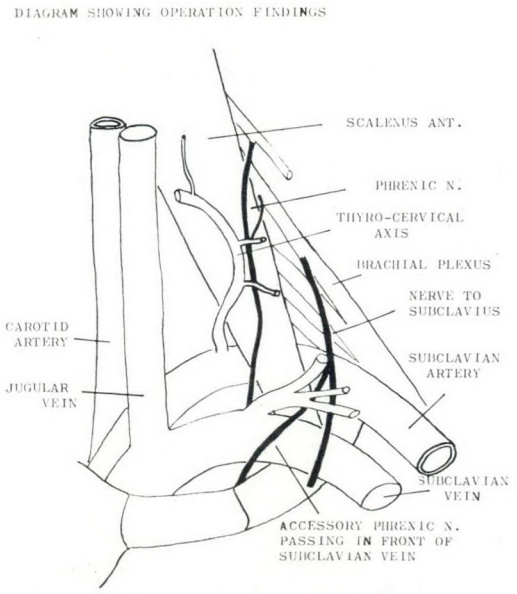

Fig. 13.—Mrs. O.S. Diagram of aberrant root of phrenic nerve causing subclavian vein obstruction.

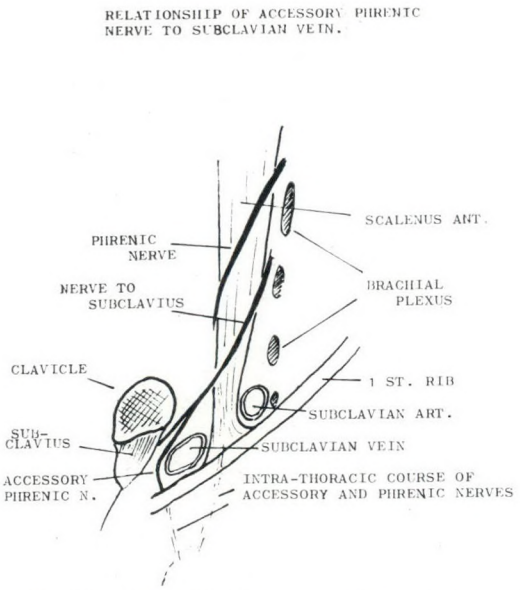

Fig. 14.—Mrs. O.S. Diagram of aberrant root of phrenic nerve as viewed from the side.

3) An exploratory operation should be carried out in patients with neurological and vascular lesions of the upper limb, if there is a reasonable possibility that a causative lesion may be situated in the thoracic inlet area. Such an operation causes no disability to the patient if a negative exploration results and it may pay worthwhile dividends if a lesion is found.

Thoracic inlet exploration should be regarded in much the same light as a laparotomy. In cases of reasonable doubt, don't guess, look!

ACKNOWLEDGMENTS

The author wishes to thank Dr. R. B. Lynn for permission to quote Case 7. He also wishes to thank those physicians and surgeons who referred these interesting problems to him.

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RÉSUMÉ

La cavité thoracique est limitée en haut par l'orifice thoracique supérieur et en bas par le diaphragme. En ce qui concerne ce dernier, il ne présente plus aujourd'hui de problèmes chirurgicaux majeurs. Il n'en est pas de même pour l'orifice thoracique supérieur à cause de son étroitesse: il est limité par les vertèbres thoraciques, la première côte, la clavicule et le sternum; il contient des organes importants: la trachée, l'œsophage, les vaiseaux sous-claviers et carotides, la chaîne sympathique, le premier nerf thoracique, le canal thoracique et le plexus bracchial. De nombreuses maladies peuvent nécessiter une action chirurgicale dans cette région: goître plongeant, tumeurs parathyroïdiennes, anévrysmes etc.

L'auteur expose ici les conclusions de ses expériences personnelles: il a eu en effet à intervenir dans l'orifice thoracique supérieur pour les cas suivants: maladie de Raynaud, angine de poitrine, dégénérescence centrale de la rétine, neurofibrome du premier nerf thoracique, syndrome de compression du plexus bracchial par côte cervicale, compression de la veine sous-clavière par un nerf phrénique aberrant, anévrysmes d'artères intercostales (1ère et 2ème), anévrysme de l'artère axillaire.

Il considère que la clef de la bonne compréhension anatomique de cette région est la dissection par une voie d'approche antérieure vers la chaîne sympathique cervico-dorsale. Un certain nombre de précautions particulières doivent être observées pour ce faire; le malade doit être placé correctement sur la table d'opération, la tête surélevée d'environ 10° pour éviter la congestion veineuse, et orientée vers le côté opposé du champ opératoire. L'incision doit être courte (environ trois pouces), passant sur le chef claviculaire du muscle sternocléido-mastoïdien. La veine jugulaire interne sera écartée vers la ligne médiane et l'on repérera alors le muscle scalène et le nerf phrénique. La séparation du scalène donne une vue beaucoup plus commode sur la région.

Dix de ces interventions menées pour différents cas sont décrites en détail.

En terminant, l'auteur insiste sur la nécéssité pour le chirurgien de bien connaître l'anatomie du diaphragme thoracique supérieur. Une exploration de cette région, si elle est raisonnablement indiquée, peut aider énormément le travail diagnostique, et si elle se révèle négative, elle ne nuit nullement au malade. Pas plus en tout cas qu'une laparotomie exploratrice.

NEW BINDING FOR THE JOURNAL

Beginning with this issue of the *Canadian Journal of Surgery* a new type of binding, "Perfect" binding, will be used to enable readers to flatten the journal more easily and to facilitate the removal of pages as desired.

CASE REPORTS

BRONCHOESOPHAGEAL FISTULA ASSOCIATED WITH ESOPHAGEAL DIVERTICULUM

G. E. MILLER, M.D., B.Sc., M.S.,* *Calgary, Alta.*

MALIGNANT DISEASE of either the esophagus or the tracheobronchial tree is the commonest etiological factor in the formation of acquired fistulous communications between these two structures, and, according to Coleman and Bunch,[1] accounts for 50% to 60% of such lesions. Without exception these are hopeless cases. Occurring less frequently, but still in significant numbers, are those bronchoesophageal fistulas due to trauma (28%) and those due to a specific infection such as tuberculosis or lues. Those related to tuberculosis most commonly arise as a result of rupture of a caseous focus into both structures. Broncholithiasis may be incriminated less commonly particularly if, as pointed out by Davis,[2] there is a history of coughing up broncholiths. Luetic fistulas apparently develop as a result of ulceration of gummata.

Fistulas complicating tuberculosis and syphilis have been less common in recent years, owing to the advent of specific antibiotic therapy for the primary disease.

Fistulas associated with esophageal diverticula are of relatively rare occurrence and Stewart *et al.*[3] in 1958, were able to find only 21 such cases in the world literature. It is generally felt that these diverticula are produced by contraction of inflammatory lesions in the vicinity of the esophagus. The development of a fistula between the diverticulum and the tracheobronchial tree is the result of either extension of the original inflammatory process or perforation of an inflamed and ulcerated diverticulum into the adjacent structure.

Fistulas associated with an esophageal diverticulum usually communicate with a primary or secondary bronchus and rarely with the trachea itself. Such bronchoesophageal fistulas occur twice as often on the right side, contrary to what might be expected from the close anatomical relationship between the left main bronchus and the esophagus.

These fistulas are usually under 2 cm. in length, extending from the anterior or anterolateral aspect of the esophagus to the membranous posterior aspect of the bronchus involved. Most commonly they are less than 1 cm. in diameter and occasionally may measure only 1 mm. or 2 mm.

Characteristically, these fistulas are associated with paroxysmal coughing after ingestion of fluid or solid foods. During these paroxysms specimens of the ingested material are coughed up from the tracheobronchial tree. These patients frequently give a history of being able to swallow satisfactorily only in the supine position. As a result of the recurrent soiling of the tracheobronchial tree, either bronchitis or pneumonitis complicates the picture and lung abscesses and bronchiectasis are common in long-standing cases.

Hemorrhage may occur from the fistula itself or from the lung abscesses or bronchiectatic segments.

Diagnosis is based upon the history, roentgenologic studies and endoscopic examination. Physical examination may be of little value except to demonstrate other pulmonary changes where these exist.

CASE REPORT

E.L., a 75-year-old white woman, had a three months' history of paroxysms of choking and coughing on ingestion of liquids and to a lesser extent this also occurred with ingestion of solids. The cough was productive of phlegm, coloured by whatever liquid she had been drinking, and sometimes containing tiny particles of food. The phlegm was never blood-stained. This tendency to cough with alimentation could be avoided by the assumption of a supine position before swallowing. There was no actual dysphagia. Although her appetite remained good, the difficulty in ingestion of food had caused a moderate weight loss of 8 lb. over the three months of her illness.

During the two months before the onset

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of these symptoms, she had experienced two severe bouts of "flu", with temperatures ranging to 102° F., chills and general malaise. This condition had quickly responded to antibiotics and she had no pulmonary complications.

The patient's previous history failed to reveal anything pertinent to her present illness apart from a simple mastectomy performed elsewhere 30 years previously for an undefined tumour.

Physical examination revealed nothing of significance and routine chest radiographs were normal. A series of films taken after ingestion of iodochloral revealed a bronchoesophageal fistula extending from a diverticulum on the anterior wall of the esophagus to the posterior aspect of the left main stem bronchus, 2.5 cm. below the carina (Figs. 1 and 2). The total length of the fistula was about 2 cm (Fig. 3).

Bronchoscopy revealed a slightly roughened, inflamed area, measuring about 0.5 cm. in diameter, in the posterior wall of the left lower lobe bronchus just below the upper lobe take-off. Viewed through a right-angled telescope, a narrow passage could be seen extending posteromedially. Esophagoscopy revealed a diverticulum in the anterolateral wall of the esophagus, 24.5 cm. from the upper gingiva and measuring about 0.5 cm. in diameter. No gross evidence of malignancy was observed on either examination, and biopsies from the area were negative.

Other tests included 1st and 2nd strength tuberculin tests which were interpreted as negative. Blood count erythrocyte sedimentation rates and blood serological test for syphilis were all normal. Bronchograms of the left side of the tracheobronchial tree showed no evidence of bronchiectasis.

On April 14, 1960, a left thoracotomy was performed. The esophagus was mobilized above and below its fistulous communication with the left bronchial tree. The fistula, which measured about 2 cm. in length, was then freed from the surrounding tissues. Surprisingly, little reaction was apparent in the area. Two soft nodes, about 2 cm. in diameter were excised and sent for histological and bacteriological examination. The fistula was then excised and the bronchial and esophageal openings were closed with interrupted 000 silk sutures.

The lymph nodes showed only a mild lym-

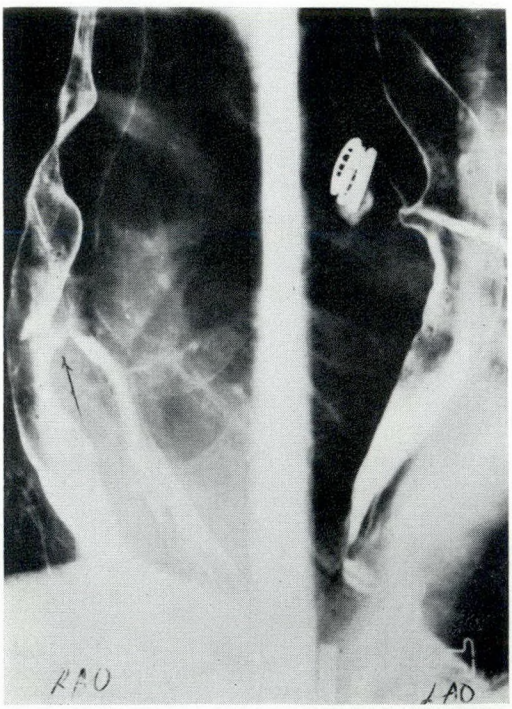

Fig. 1.—Esophagus containing Salpix is demonstrated. Salpix has filled the diverticulum and spilled over into the tracheobronchial tree. This is demonstrated in both the right anterior oblique and left anterior oblique positions.

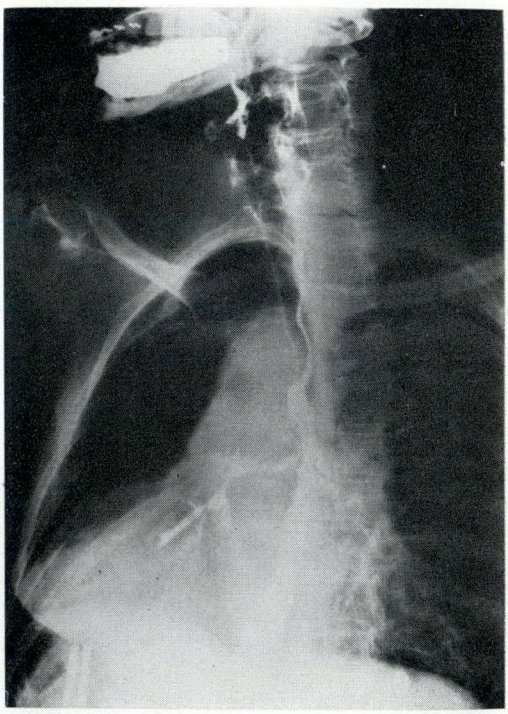

Fig. 2.—The esophagus is shown filled with dye, with the left main stem bronchus and subtending bronchi also outlined with dye. This is placed in the left anterior oblique position.

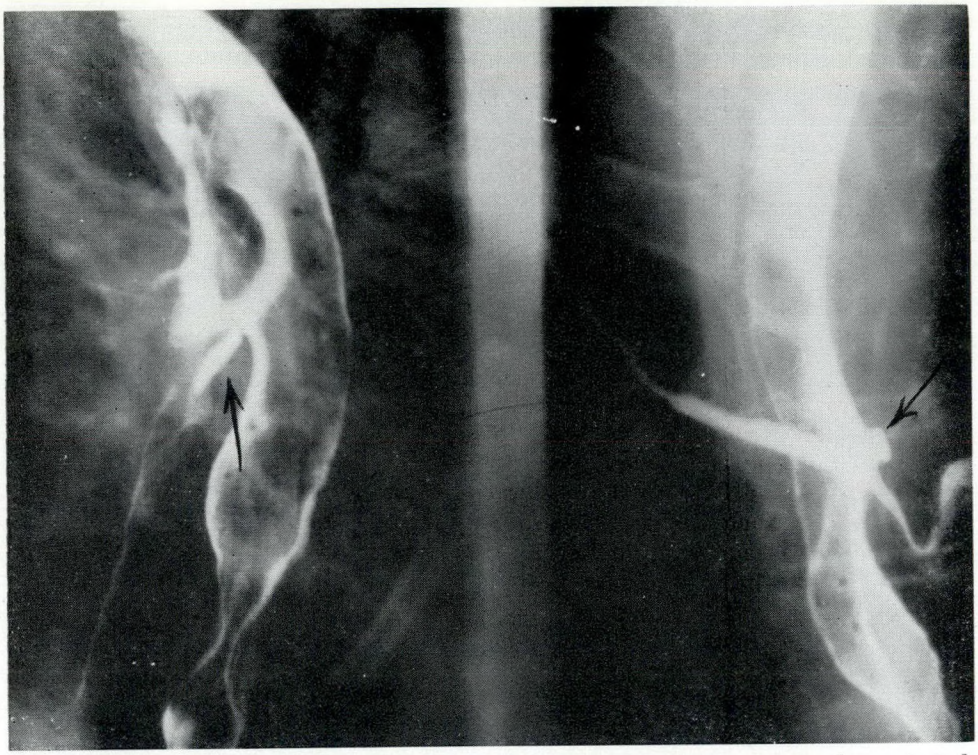

Fig. 3.—The diverticulum and its bronchial communication are again demonstrated, outlined by a radiopaque medium.

phoid hyperplasia, and bacteriologic examination was entirely negative.

The patient made a complete recovery and when seen four months later had regained the lost 8 lb. She was eating and drinking heartily and was about to depart on a trip to Europe.

Discussion

Traditionally, the findings of a bronchoesophageal fistula in a patient of this woman's age is a source of despair to the surgeon in view of the statistical preponderance of malignant etiology of such lesions.

These statistics, however, should not deter one from a thorough investigation of the case in hand, since if benign, it represents a lesion that is readily amenable to direct surgical correction. Curiously, Coleman and Bunch in 1950, reported only 25 cases, successfully treated by operation. Since then, however, numerous satisfactory results from this approach have been recorded.[4-6]

It should be pointed out that where lung involvement is extensive, simple closure of the fistula is inadequate and operation should include resection of the diseased pulmonary tissue.

Conclusion

The etiology of the diverticulum in the case described in this report remains obscure. In the presence of a negative tuberculin test a tuberculous etiology seems unlikely. Presumably she had had a nontuberculous lymphadenitis at some time in her life, which in subsiding, produced a diverticulum. It could be postulated that ulceration and perforation of the tip of this diverticulum resulted in the formation of the fistula. The relationship of the two severe "colds" earlier in the year in which her symptoms developed, is questionable.

The satisfactory outcome in this case demonstrated that a direct approach is by no means as hazardous as might be considered.

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Résumé

Ceci est la présentation d'une histoire de cas. Il s'agit d'une femme de 75 ans, présentant trois mois avant son hospitalisation un syndrome de toux violente lors de l'ingestion de liquides: les expectorations ainsi provoquées se trouvaient colorées par les liquides avalés et parfois même contenaient de petites particules alimentaires solides, mais ne furent jamais sanglantes. Cette toux à la déglutition pouvait être évitée si la malade se penchait ou se couchait en arrière. Il y avait eu une perte de poids d'environ 8 lb.

A l'examen physique on ne trouva rien de significatif. Les radiographies pulmonaires étaient normales. Cependant une série de films faits après ingestion d'iodochloral révéla l'existence d'une fistule broncho-œsophagienne située entre un petit diverticule de la paroi antérieure de l'œsophage et la partie postérieure antérieure de principale gauche à 2.5 cm. en dessous de la carine. Cette lésion fut retrouvée à la bronchoscopie.

On procéda donc à une thoractomie, à gauche. Le trajet fistuleux fut disséqué et l'on ne trouva dans la région que deux petits ganglions lymphatiques. Après excision, la bronche et l'œsophage furent soigneusement suturés. L'examen anatomopathologique des pièces ne montra qu'une hyperplasie lymphoïde discrète: l'examen bactériologique fut négatif. Les suites post-opératoires furent excellentes.

Dans ce cas, l'étiologie reste obscure.

A HISTORY OF PSYCHIATRY. Jerome M. Schneck, Clinical Associate Professor of Psychiatry, State University of New York College of Medicine, New York City. 196 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $6.00.

The author, in taking as one of his aims in writing this History of Psychiatry "the enhancing of perspective" has set himself a difficult task. He has increased his difficulties by attempting to cover an immense period of time in only 166 pages of text. In the opinion of the reviewer, Dr. Schneck was unequal to the task. What has been produced is a beautifully bound and printed volume containing capsule comments about a great many prominent psychiatric figures. No attempt is made to account for the bewildering variety of thoughts and practices over these many years, so that the reader, while perhaps gaining facts, gains little in understanding or perspective. One is left with the impression that truth about the nature of man and deviant behaviour began to emerge only with Freud and that prior to him, psychiatric thinkers were variously quaint, muddled, mad, kind or sometimes vicious people. When dealing with the story of mankind's attempts to understand and control his physical environment it is possible to make out a good case for the view that there has been progress, in the sense that this implies improvement or enlightenment. Considering the present unvalidated state of knowledge, the lack of positive evidence for the effectiveness of our methods, it is not easily possible to think of the history of psychiatry as the story of progress. What one can do is to make explicit the basic assumptions that exist about the nature of man and then approach history as an account of the thoughts and practices that particular men have developed from these assumptions. For example, one clear trend in history has followed from the assumption that the essence of man is spirit or mind. From this axiom has come the elaboration that this spirit is capable of beng influenced or shaped in ways that determine the behaviour of man. For some, the influencing force has been a primary spirit or God; for others it has been nature as lawful biological force; for still others, society in the variable sense of collective unconscious or collective sentiments and beliefs. Making this assumption explicit allows one to see the connection between the apparently disparate views of "primitive" thinkers, theologians, sociologists, psychoanalysts, and authors of the Malleus Maleficarum and Jungian psychologists. The basic assumption of medical theory that behaviour depends on the function of brain cells and that deviant behaviour is the result of damage to these cells outlines another historical trend. This allows one to see the connection between the thinking of Hippocrates, Galen, Erhlich, Noguchi, Virchow, Sakel, Moniz and others. Yet another trend appears to follow from humanist sentiments rather than theory. This connects Pinel, Tuke, Dorothea Dix and others. It is regrettable that the author found no such means of bringing coherence to his volume. For this reason it is difficult to recommend the book to its intended readers.

CARCINOMA OF THE STOMACH FOLLOWING GASTRECTOMY OR GASTROENTEROSTOMY FOR BENIGN PEPTIC ULCER

W. H. McCRAE, M.D. and I. B. MACDONALD, M.D., M.S., F.R.C.S.[C], *Toronto*

IN RECENT YEARS there have been increasing numbers of published reports of carcinoma of the stomach occurring in patients who had previously undergone gastroenterostomy or partial gastrectomy for benign peptic ulcer. The incidence of malignancy after either of these surgical procedures has been reported to be small. However, Helsingen and Hillestad[1] have concluded from their observations that patients with gastric resections for benign gastric ulcer had an incidence of subsequently developing carcinoma that was three times as great as the incidence of gastric cancer predicted statistically for the general population of Norway. They also reported that patients who had undergone similar operations for duodenal ulcer did not exhibit this increased incidence of subsequent gastric carcinoma.

Côté, Dockerty and Cain,[2] on the basis of an analysis of gastric cancers recorded over a 50-year period, concluded that the small number of cases in which carcinoma arose in the gastric remnant indicated that gastric carcinoma was not a common complication of the surgical treatment of peptic ulcer.

In 1950, Orringer[3] reviewed 1160 cases of cancer of the stomach from the records of Mount Sinai Hospital, New York, and reported a 0.4% incidence of carcinomas developing later in the gastric remnant. This finding supports the non-statistical studies of Côté *et al.* and is in agreement with the observations of other authors.[4-7]

An interest in this problem was stimulated by the following case encountered recently on the surgical service of the Wellesley Hospital,* Toronto.

CASE REPORT

Miss I.B., aged 58 years, had undergone gastroenterostomy for a benign duodenal ulcer in 1928. She remained well and free of gastric symptoms for the next 26 years. In 1954, routine physical examination revealed a firm mass in the region of the pylorus. A laparotomy was performed and a fibrous, benign pyloric stenosis was discovered. After a pyloroplasty the patient enjoyed a further period of good health, although at times she exhibited an iron-deficiency anemia. In 1959, however, several months of weight loss and a shorter period of recurrent epigastric distress led to her admission to hospital.

Upon examination, the patient was found to have an irregular, hard mid-epigastric mass. The liver and spleen were moderately enlarged, firm and non-tender. Laboratory findings included a hemoglobin of 72%, hematocrit of 37.5% and normal serum proteins and liver function tests. She had no demonstrable free acid in her gastric contents. Laparotomy revealed a non-resectable neoplastic mass along the lesser curvature of the stomach with secondary tumour in the celiac glands, about the pancreas and in both lobes of the liver. Her recovery from the laparotomy was uneventful.

In order to determine the incidence of gastric remnant carcinomas at this centre, the files of the Toronto General Hospital were examined and cases were reviewed of gastric cancer diagnosed over the period 1944 to 1958 inclusive.

In all, 1136 cases were indexed under the diagnosis of carcinoma of the stomach during this 15-year period. Of these, 79 were excluded because the records were inadequate for the purpose of this study. This left 1057 cases for review. It is of some interest that 824 (80%) of these patients underwent operation. About one-half of those subjected to laparotomy (440 cases or 41.6% of the 1057 cases) were found to have resectable tumours.

In only four cases in the entire series was carcinoma of the stomach diagnosed after a previous laparotomy for apparently non-malignant disease. Their principal findings together with those of the aforementioned case are listed in Table I.

In Cases No. 3 and 4, no biopsy material was obtained at the time of the first operation by which to verify the benign nature of the original ulcer. Also, the time that

*Formerly the Wellesley Division, Toronto General Hospital.

TABLE I.—Carcinoma of the Stomach Following Resection or Enteroanastomosis for Benign Peptic Ulcer

Toronto General Hospital 1944 - 1958

		Primary operation				*Diagnosis of gastric cancer*		
No.	*Sex*	*Age*	*Year*	*Type of operation*	*Diagnosis*	*Year*	*Interval (years)*	*Treatment*
1	M	52	1946	Pyloroplasty	Pyloric stenosis	1949	3	Gastric biopsy Cholecystectomy
2	F	68	1944	Posterior gastro-enterostomy	Duodenal ulcer	1947	3	Laparotomy and biopsy of lesser omentum
3	M	54	1941	Polya gastrectomy	Chronic gastric ulcer	1945	4	Gastro-jejunostomy
4	M	73	1955	Anterior gastro-enterostomy	Duodenal ulcer	1956	1	Laparotomy and enteroenterostomy
5	F	27	1928	Gastroenterostomy	Duodenal ulcer	1959	31	Laparotomy and biopsy

elapsed until the diagnosis of cancer was established, was considerably shorter than that observed by any of those in other centres who have reported their studies of gastric remnant cancers.[1, 7, 8] The time period between incomplete resection of malignant gastric ulcer and the recurrence of malignancy has been reported as approximately one to three years,[9] and such was the elapsed time in three of the five cases listed in this series. If none of these patients had cancer at the time of their first operation, the Toronto General Hospital incidence of gastric remnant carcinomas would be but 0.4% at most.

Summary

A case is reported in which gastric cancer was diagnosed 26 years after gastroenterostomy was performed for duodenal ulcer. Of a total of 1057 well documented cases of gastric cancer diagnosed between 1944 and 1958 at the Toronto General Hospital, four patients had previously undergone operation for supposedly benign peptic ulcer. The incidence of gastric remnant cancer at this hospital for the stated period of 15 years did not exceed 0.4% and was probably less. This incidence is at least as low as that reported by Orringer. The opinion is substantiated that, notwithstanding the statistically increased incidence of this malady in the painstaking Norwegian survey, gastric cancer develops infrequently after partial gastrectomy for benign peptic ulcer.

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Résumé

Sur un total de 1057 cas bien établis de cancer gastrique vus à l'Hôpital Général de Toronto entre 1944 et 1958, quatre patients seulement avaient subi dans leur passé une intervention pour ulcère peptique considéré comme bénin.

Un de ces cas est rapporté ici.

Une femme de 58 ans avait été opérée en 1928 pour un ulcère duodénal bénin: on avait pratiqué une gastro-entérostomie. En 1954 un examen médical de routine permet de découvrir l'existence d'une masse dans la région du pylore: une laparotomie est faite, au cours de laquelle on procède à une pyloroplastie pour sténose bénigne du pylore. Jusqu'en 1959, la malade se porte bien. Peu après, cependant, une perte de poids s'étendant sur plusieurs mois et des troubles gastriques la font réadmettre à l'Hôpital.

On constate alors une tuméfaction intra-abdominale dans la région épigastrique. Le foie et la rate sont légèrement hypertrophiés. L'analyse du suc gastrique indique une absence d'acide libre. Une laparotomie est alors pratiquée: ceci permet de découvrir une grosse tumeur non réséquable située sur la petite courbure gastrique, ayant envahi le pancréas et le foie.

Il semble bien, dans ce cas, que la néoplasie est apparue après les deux premières interventions.

THE CASE REPORTS AND AUTOPSY RECORDS OF AMBROISE PARE. Translated from J. P. Malgaigne's "Œuvres Complètes d'Ambroise Paré", Paris 1840. Compiled and edited by Wallace B. Hamby, M.D., F.A.C.S., Department of Neurological Surgery, Cleveland Clinic, Cleveland, Ohio. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $7.25.

Ambroise Paré is rightly regarded as one of the great figures in surgery and has been called the "father of modern surgery". His life spanned almost the entire 16th century and he was therefore exposed to the ferment of ideas which is termed the Renaissance and which transformed medical philosophy equally with other branches of human thought and endeavour. War too has often been responsible for revolutionizing men's ideas and Paré was the first true military surgeon who learned by his experience and profited from it.

This little book contains his notes and observations on the cases which came under his notice or which he personally treated throughout his career and, though the records are often brief, they are very much to the point and make fascinating reading. Among others we find here his original description of the famous occasion when he applied soothing application in place of boiling oil to gun-shot wounds, his anxiety during the ensuing night as to the outcome and his relief on the following morning when he discovered that the wounded, whom he had treated in this unorthodox fashion, were very much better than those who had received the then orthodox treatment of boiling oil. His comment was "Then I resolved never again to so cruelly burn the poor, wounded by gun-shot".

His well-known dictum "I dressed him, God healed him" occurs frequently in these case records.

This little book is well worthy of being read by all surgeons who are interested in the history of their art, and we are indebted to Dr. Hamby for making it available to us in such a readable translation.

THE SURGEON'S GLOVE. Justine Randers-Pehrson, M.A. 95 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $5.00.

This is a delightful and well written account of the introduction and acceptance of the use of rubber gloves in surgery. It is obviously based on careful and painstaking research into the literature of the subject. The reader is taken on a guided tour of developments from the earliest hand-covering of sheep's cecum (used to prevent the attendant's fingernails from scratching obstetrical patients) in the middle of the 18th century, to leather, cotton and silk gloves, often used to facilitate surgical manipulation or to protect attendants rather than patients. After these early days, rubber gloves were introduced towards the end of the 19th century and, surprising as it may seem to us, many reputable surgeons were opposed to the use of any type of glove. It is equally surprising to read of controversy over the claims for the superiority of fabric gloves over rubber gloves. During this period it was not always clear whether the gloves were intended to protect the patient or the surgeon. There are interesting sidelights on the rise of antiseptic, and then aseptic methods in surgery, as the authoress shows how the use of rubber gloves became universal as an integral part of the aseptic method.

No biographical details of the authoress can be found in easily available sources, but this slim, well illustrated volume speaks for itself; it is scholarly, interesting and easy to read. There is little to criticize adversely although the distinction between latex-dipped and solution-dipped rubber gloves is not altogether clear, and it is startling to come across a description of the famed Mikulicz as one of the "all-time greats" of surgery.

CHANGE OF ADDRESS

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SEMINOMA IN A NONAGENARIAN COMPLICATED BY PATHOLOGICAL FRACTURE OF THE HUMERUS

J. G. CONNOLLY, M.D., F.R.C.S.(E)* and E. L. WRATHALL, M.D., *Port Hope, Ont.*

A SEMINOMA is not a common tumour. It accounts for 35%-45% of malignant testicular neoplasms. It is rare before the age of 30, the mean age at operation is in the forties,[1] and it is uncommon in the older age groups. Distant spread is principally by the lymphatics to the regional lymph nodes. Later and less commonly it spreads by the bloodstream to the lungs and liver, and only occasionally involves other organs.

The following case is unusual in several respects and is therefore being recorded.

CASE REPORT

C.M., a 90-year-old man was first seen by one of us (E. L. Wrathall), when he presented with a two-month history of a painless swelling of his right testicle. His other complaints were dyspnea and nocturnal urinary frequency of long duration. There was no history of trauma or instrumentation of the urinary tract.

On physical examination he was found to be a rather well preserved man for his years. Examination of the head and neck revealed no abnormal findings and there were no enlarged cervical lymph nodes. The respiratory and cardiovascular systems were within normal limits for his age. His blood pressure was 155/95 mm. Hg. Abdominal examination revealed no enlargement of the liver, and no abdominal masses were palpable. The right side of the scrotum contained a moderate hydrocele, and the right testicle could be palpated. It was felt to be irregularly enlarged at its lower pole, and the testicular sensation was reduced. The left testicle was found to be atrophic. On rectal examination there was a grade 2 enlargement of the prostate, and the gland was moderately hard. His hemoglobin was 11.8 g. %, the urine contained a trace of albumin but no pus, the blood Wassermann reaction was negative, and the chest radiograph was clear. A tentative diagnosis of malignant testicular tumour with a secondary hydrocele was made.

A skin crease incision was made in the right inguinal region under local anesthesia. The spermatic cord was exposed, ligated at the internal inguinal ring, and the cord and testicle were then removed. Hemostasis was secured, the scrotum was drained and the wound was closed in layers. On opening the specimen, the tunica vaginalis was found to be thickened and the sac contained a straw-coloured fluid. The body of the testicle was enlarged, principally at its lower pole. The tunica albuginea was intact. The cut surface of the testicle was greyish-white in colour, with numerous hemorrhagic areas. The epididymis appeared normal. Microscopic examination revealed a seminoma of the testicle (Figs. 1 and 2).

The patient made an uneventful recovery and was discharged 10 days postoperatively.

The patient was seen next, approximately three years later. At this time he complained of a feeling that "something had given" in his right arm. This had happened that morning

Fig. 1.—Low power view of specimen showing tumour cells infiltrating the tissue (original magnification x 80).

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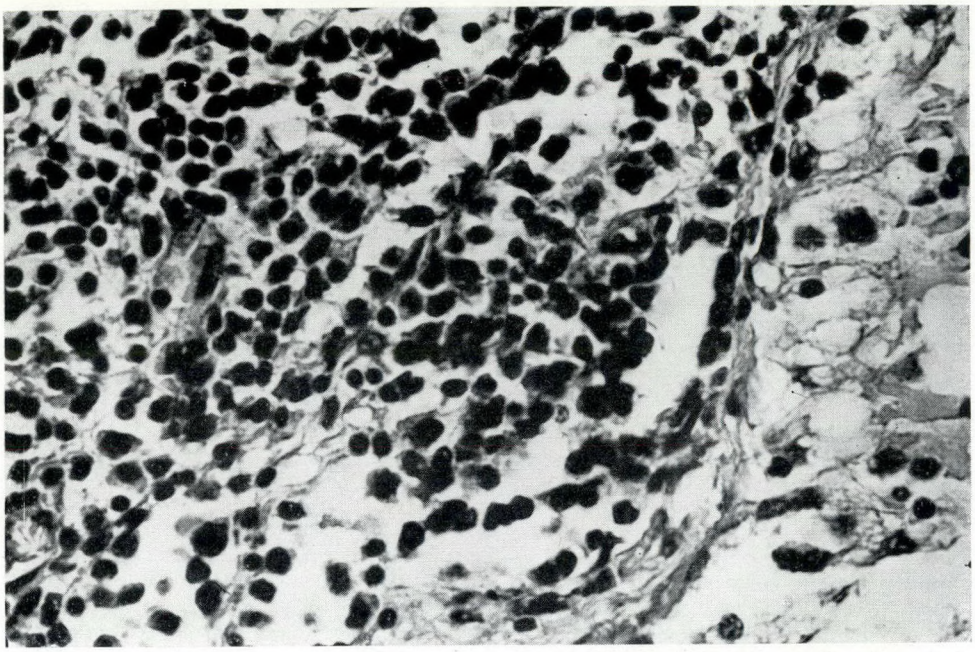

Fig. 2.—High power view of the tumour showing small cells with round nuclei which vary in size and shape and stain very darkly with hematoxylin (original magnification x 500).

while he was opening a drawer. On examination he was found to have an obvious supracondylar fracture of his right humerus. Functional enquiry disclosed no new symptoms since his previous visit. Physical examination revealed a reasonably well nourished old man. There was no cervical lymphadenopathy and the heart and lungs were found to be within normal limits for his age. No abdominal masses were palpable. There was a well healed right inguinal scar. The left testicle was atrophic. The prostatic enlargement was unchanged. His blood pressure was 165/100 mm. Hg, his hemoglobin was 12.2 g. %, and the red blood count was 4.2 million per c.mm. The urine contained 2+ albumin. A radiograph revealed a fracture through a large osteolytic lesion in the lower third of the right humerus (Figs. 3 and 4). A chest radiograph was considered to be within normal limits. A radiological bone survey was carried out and several small osteolytic lesions were noted in the right inferior ischiopubic ramus.

A needle biopsy of the lesion in the right humerus was carried out under local anesthesia. Microscopic examination of the aspirated material revealed a metastatic seminoma (Fig. 5).

Discussion

Testicular tumours represent 2% of malignant tumours in men,[2] and seminoma comprises from 35%-65% of these in the various series reported. Seminomas appear to have a familial incidence and they are the commonest tumours to appear in undescended testes, making up some 80% of these neoplasms.[3]

A simple pathological classification of testicular tumours is difficult. Some pathologists feel that all testicular tumours arise from primitive germ cells and that seminomas are a one-sided development of a teratoma. Others believe that the seminoma is a distinct tumour that arises from the seminiferous tubules. Bell,[4] after a careful study of this subject, was of the opinion that these growths fell into two groups, teratomas and seminomas. Pure seminomas as such do occur but in practically every series one finds evidence of mixed tumours. In one large series, seminomatous tissue was found in 20% of embryonal carcinomas and teratomas.[3] The architecture of testicular tissue is not reproduced in seminomas and the tumour cells do not resemble spermatogonia.[3]

The clinical behaviour of these tumours is variable. Gordon-Taylor[5] divided them into four clinical groups: (1) An "average" type which is slow growing: (2) A "hurri-

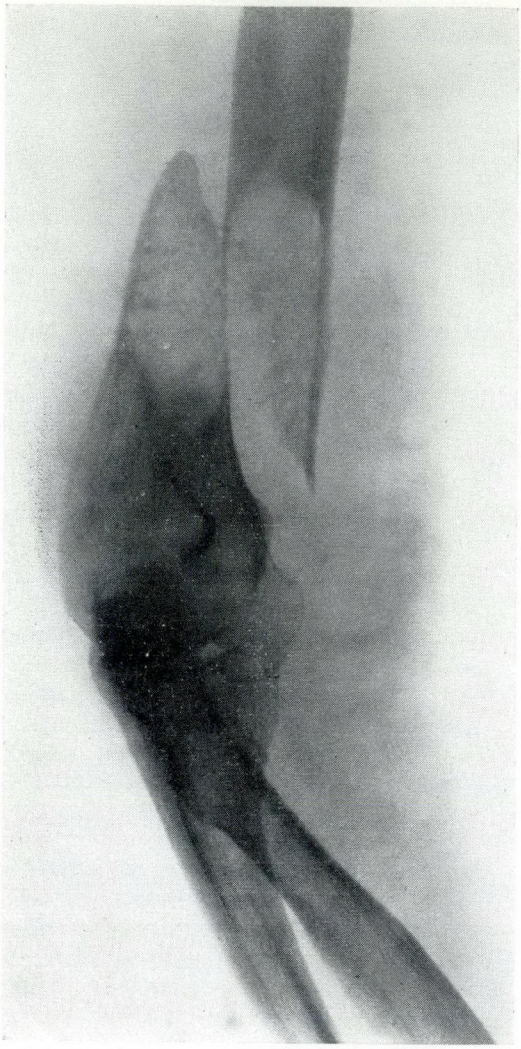

Fig. 3.—Radiograph of the lower end of the humerus showing the oblique fracture through the osteolytic lesion in the lower third of the humerus.

cane" type which metastasizes early: (3) An "encapsulated" type which may remain quiescent for years, and (4) "abdominal secondaries", presenting before the primary growth has been discovered. Local symptoms may take the form of a lump in the testicle or of a dragging sensation in this region. The general symptoms may include hemoptysis, dyspnea, abdominal pain, cerebral symptoms, or as in this case, manifestations of a pathological fracture. On local examination there may be a testicular swelling and/or a secondary hydrocele. More extensive examination may reveal abdominal masses, enlargement of the liver or evidence of metastases elsewhere. The differential diagnosis of the testicular swelling includes orchitis, gumma, testicular infarction, tuberculosis of the epididymis, benign tumours, hematocele, simple cysts of the tunica vaginalis, and primary hydrocele.

The pattern of spread of these tumours is well known. Locally they spread to the cord and epididymis and occasionally break through the coverings of the testes to the skin; in such an event the inguinal lymph nodes may be involved. The early distant spread is by way of the lymph vessels which leave the mediastinum testis in company with the veins of the cord and pass to the lumbar nodes. These nodes lie within an area which extends from the renal veins to the level of the bifurcation of the aorta, and from one finger's breadth to the right of the inferior vena cava to one finger's breadth to the left of the aorta. Later, and less frequently, the tumour spreads by the blood stream, principally to the lungs and liver, occasionally to the brain and rarely elsewhere. Badenoch[6] mentions paraplegia secondary to metastatic deposits in the lumbar vertebrae as a presenting symptom in some cases. It is difficult to determine how frequently these tumours metastasize to bone. Unfortunately in some of the largest series such as Friedman's group of 922 cases in service personnel, it was not possible to define the distribution of late metastases.

Summary

A case of seminoma of the testis in a 90-year-old man is presented. Pathological fracture of the humerus at the site of a metastatic deposit occurred three years after removal of the primary growth. The clinical manifestations of this type of neoplasm are briefly reviewed.

Acknowledgment

We wish to thank Dr. J. B. McKay, Provincial Pathologist, for the preparation of the photomicrographs.

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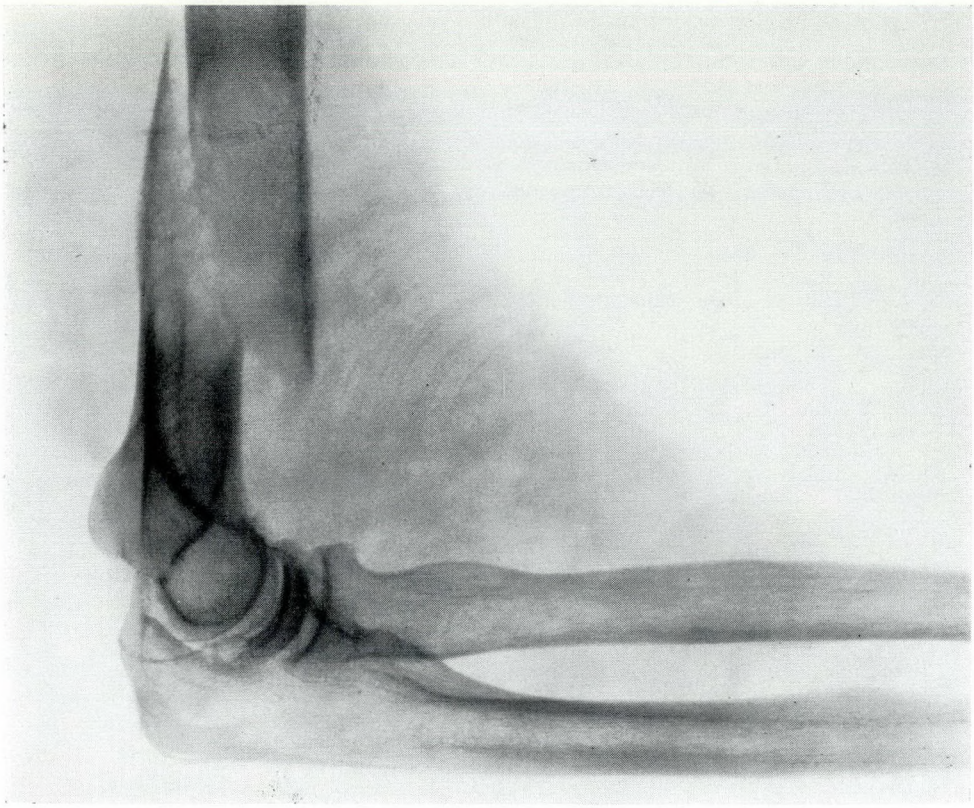

Fig. 4—Lateral view of the lower end of the humerus showing the metastatic deposit and the fracture.

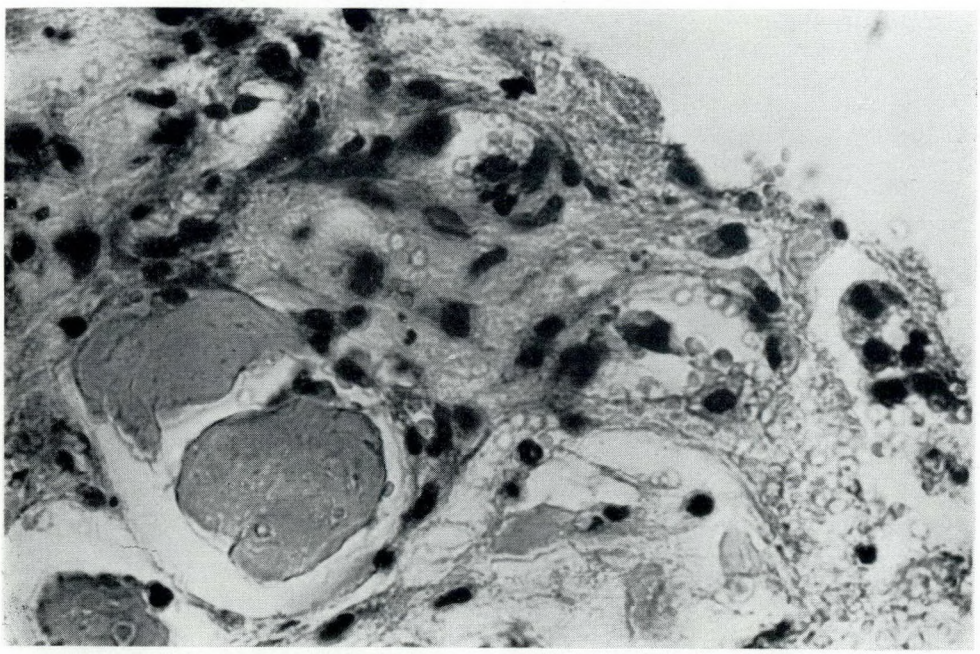

Fig. 5.—High power view of tissue aspirated from the osteolytic lesion showing the typical tumour cells which are darkly staining and vary in size and shape (original magnification x 500).

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RÉSUMÉ

Le séminome est une tumeur rare, ne représentant que 35% à 45% des tumeurs testiculaires. Le cas présenté ici est peu ordinaire à plusieurs points de vue.

Il s'agit d'un homme de 90 ans se plaignant de douleurs et d'enflure de son testicule droit remontant à deux mois auparavant, sans aucun contexte traumatique. L'examen physique ne révéla pas de pathologie générale grave; le scrotum se trouvait distendu du côté droit par un épanchement d'hydrocèle d'importance moyenne, à travers lequel le testicule restait palpable: ce dernier était tuméfié de façon irrégulière à son pôle inférieur; rien à signaler à l'examen rectal, si ce n'est une hypertrophie modérée de la prostate. Les examens de laboratoire étaient normaux. Une exploration fut faite par voie inguinale: le testicule droit fut enlevé de la façon habituelle. Les suites opératoires furent excellentes.

L'examen anatomo-pathologique du testicule montra un séminome.

Le malade fut revu trois ans plus tard pour une fracture de l'humérus droit: à la radiographie, cette fracture était provoquée une large zone d'ostéolyse; des lésions du même genre, mais n'ayant pas entrainé de fractures furent dépistées sur les clichés du squelette. Une ponction exploratrice du foyer huméral ramena des cellules qui étaient des métastases du séminome.

THE PRACTICE OF GRIMNESS

"The genocidal love affair between Americans and automobiles, which resembles nothing in the world so much as a rabbit hypnotized by a cobra, until recently gave no sign of yielding to admonitions or rational thought. Instead, the monster went its way, killing outright nearly 40,000 people a year and at leisure consuming the rest: indispensable, otiose, junky, improbable, it has served as an emotional vehicle for the ungrown and as the backbone of a near-civilization that may be remembered for its superhighways. They do it differently in Erehwon, where the driver of an automobile is quietly executed on the spot, a method that reasonably safeguards him from another accident. In time we too may develop a regard for human life.

"An early sign appeared this summer in Pennsylvania, where all new drivers must have their physician's certification that they can see well enough and have the neuromuscular integrity to control an automobile, and that they are not dyspneic with heart failure, alcoholic, diabetic (uncontrolled), or subject to lapses of consciousness or certain other handicaps. If emotional unfitness is still too hard to assess, though the most lethal of all, the achievement in Pennsylvania is marvelous notwithstanding. It asserts for the first time that driving an automobile is not included in the Bill of Rights. The impression that it was, might have been due to the predecessor vehicle, the horse and buggy, but never extended to, say, flying an airplane.

"Now, and not for the first time, the physician is placed in a pivotal and often distressing role by the law of certification. It will become necessary to exhort these unfit drivers not to drive, and not to *want* to drive, for their own sake. There will be the usual run of highly exceptional circumstances, the routine 'hardships' and special cases, in view of which the physician ought to be 'more reasonable' and the inspired new law edentulous. Really to make the law work, physicians will have to be difficult and even grim. That was the experience in aviation: no one, in order to be a good fellow, signed a poor devil's life away, and the example can well be carried into driver certification. It will be worth any trouble."

Editorial: *Medical Tribune*, Nov. 14, 1960.

EXPERIMENTAL SURGERY

A METHOD OF INTRODUCING BLOOD INTO THE SUBARACHNOID SPACE IN THE REGION OF THE CIRCLE OF WILLIS IN DOGS*

W. M. LOUGHEED, F.R.C.S.[C]† and MARY TOM, M.B.,‡ *Toronto*

Introduction

The purpose of this paper is to report the results of a study of the effects of arterial blood introduced into the subarachnoid space in the region of the circle of Willis. This project was stimulated by the need for better understanding of the pathological and physiological events which occur when a berry aneurysm ruptures. By this method, it is hoped to segregate the effects ensuing after the rupture of an aneurysm, such as arterial spasm and thrombosis, from the effects directly attributable to the release of blood into the subarachnoid space.

Bagley,[1] in 1928, carried out a series of experiments with the injection of blood into the subarachnoid space. However, these experiments differ from those to be described. In Bagley's series, multiple injections were used, and the blood was either introduced into the cisterna magna, or over the cerebral hemispheres. It was felt that better approximation to the clinical course of events might be obtained by injecting blood close to the site at which it arises when an aneurysm ruptures (i.e. the region of the circle of Willis).

Method

Adult mongrel dogs weighing between 20 kg. and 30 kg. were chosen for this experiment. Preoperatively, they were brought to the laboratory and allowed to become accustomed to their surroundings. Their actions and responses were carefully recorded. On the day of operation, the animals were anesthetized with intravenous sodium thiopental, and anesthesia was maintained during the operative procedure by an intravenous drip of a solution of sodium thiopental, 1 g. in 500 c.c. of normal saline. When the animal was anesthetized, the spinal fluid pressure was measured either by cisternal puncture or by a lumbar puncture after a laminectomy had been performed.

The needle used for determining the spinal fluid pressure was a No. 20 gauge needle to which was attached a short length of flexible polyethylene tubing (Fig. 1). By using flexible tubing, it could be lowered or raised in order to fill the entire tubing with spinal fluid, and several independent recordings could be made of the spinal fluid pressure.

The procedure of introducing the blood into the subarachnoid space is based on the method of Aschner used for oral hypophysectomies in dogs, as described by Markowitz.[2]

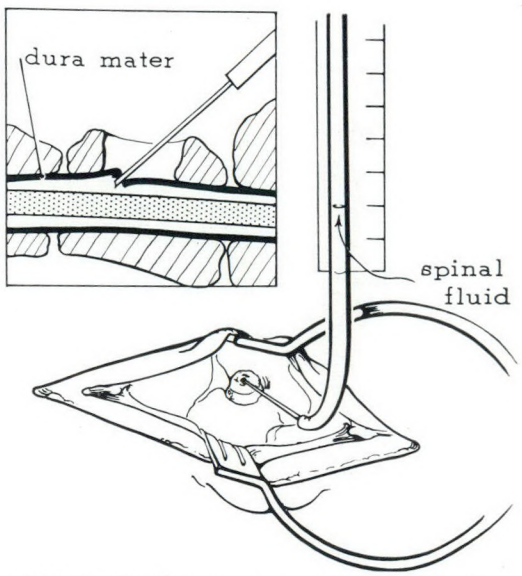

Fig. 1.—Lumbar puncture. The muscles have been reflected off the lamina and the spinous process removed. A burr hole has been made in the lamina to expose the dura. A No. 20 gauge needle is inserted through the laminectomy defect and through the dura into the subarachnoid space. The spinal fluid pressure is measured on a centimetre scale.

*This research has been supported by National Health Grant No. 605-7-162.
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‡Division of Neuropathology, Department of Pathology, University of Toronto.

The anesthetized dog is placed on its back and a wide oral exposure is obtained by placing metal rods protected with rubber behind the upper and lower incisor teeth (Fig. 2). The rods are then separated so that the mouth is held open. A suture is placed through the tip of the tongue, which is then tied securely to the neck of the animal so that the tongue is pulled out of the mouth, and over the upper horizontal bar (Fig. 2). The mouth is cleansed thoroughly with tinted tincture of benzalkonium chloride. Sterile towels are used to drape the operative field. The cutting current is used to incise the soft palate in the midline from the point of its junction with the hard palate to within a half inch of the posterior free margin (Fig. 3). The halves of the soft palate are retracted laterally by means of a small self-retaining retractor. The mucous membrane of the nasopharynx is then prepared with benzalkonium chloride, and an incision, using the cutting current, is made in the midline through the mucoperiosteum of the nasopharynx. The mucoperiosteum can then be dissected from the base of the skull by means of a periosteal elevator, and the flaps of mucoperiosteum can be sutured laterally to the retracted edges of the soft palate. In order to obtain better exposure, two small moistened pledgets of cottonoid can be used at the upper and lower margins of the incision in the mucoperiosteum to hold it laterally and also control any bleeding. The exposed bone is washed with saline, and any bony bleeding points are cauterized. The landmark now encountered is the intersphenoid suture between the anterior and posterior sphenoid bones. These occupy the midsagittal plane of the exposure and are separated from the pterygoid bones by two suture lines (Fig. 3). These suture lines, as they progress anteriorly, follow a gentle curving course towards the midline, and at the level of the posterior margin of the hard palate are separated from each other by only one-eighth of an inch. Just caudal to the intersphenoid suture is a small emissary vein which marks the site of the craniopharyngeal canal. Caudal to this emissary vein lies the pituitary gland, and anterior to the emissary vein and intersphenoid suture lies the region of the cisterna chiasmatis (Fig. 3). A small hole can be drilled through the base of the skull just anterior to the emissary vein and intersphenoid suture to expose the dura. A drill, three-eighths of an inch in diameter, has been used for this purpose. Care must be taken to make the drill hole slowly so that the dura is not torn. Bleeding from the bone may be controlled by the use of bone wax. When the dura has been exposed, it should be bluish in colour. This identifies the area as the chiasmatic cistern. If the dura is whitish or pink in colour, the hole has been placed too far posteriorly and lies over the pituitary gland. If this difficulty is en-

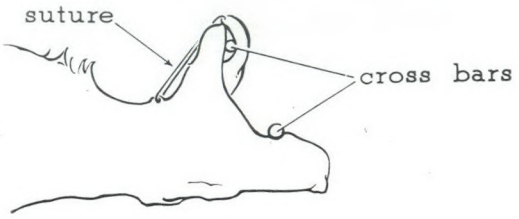

Fig. 2.—The dog is placed in supine position on the operating table. The mouth is held open by parallel rods. The tongue is retracted by suture.

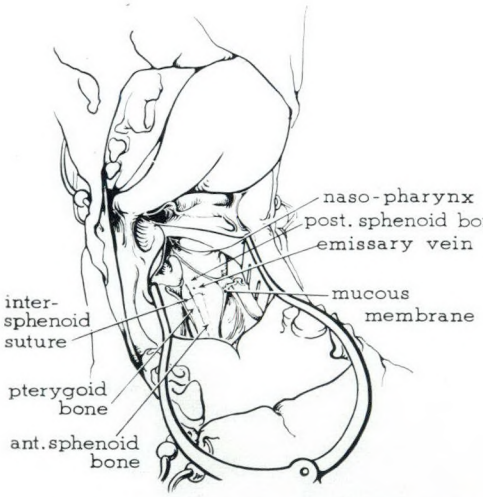

Fig. 3.—The soft palate has been incised and its halves are held retracted. The mucous membrane flaps are held laterally by stitches exposing the base of the skull. The intersphenoid suture line lies in the coronal plane in front of an emissary vein. Two suture lines embrace the sphenoid bones and lie in the sagittal plane gently curving toward each other as they extend anteriorly.

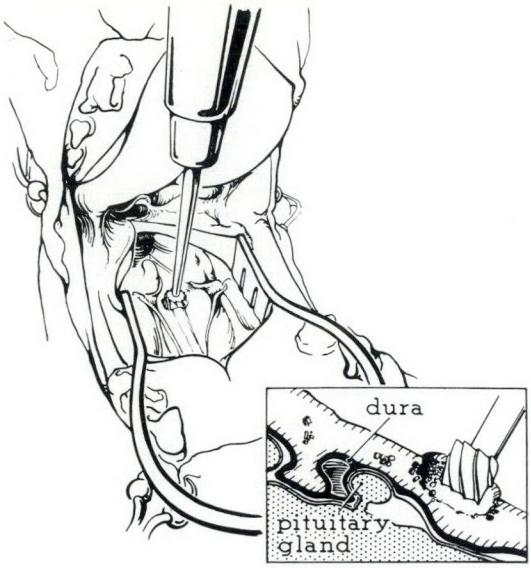

Fig. 4a.—A burr is used to cut an aperture through the bone to the dura just in front of the pituitary gland.

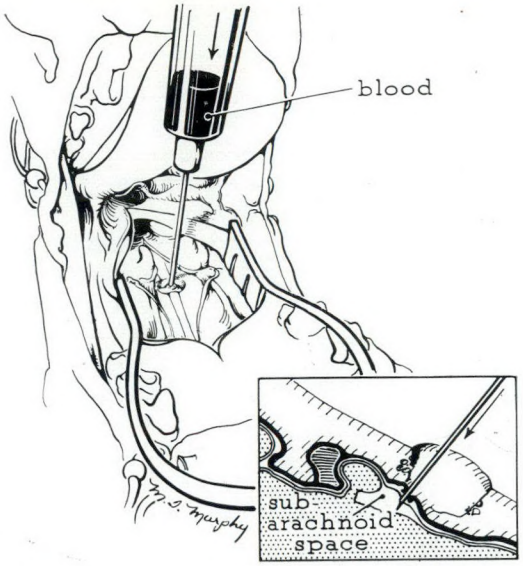

Fig. 4b.—The polythene tubing separating the needle and the syringe is not shown. This tubing is important because it allows the needle to be held still while an assistant outside the operative field carries out the injection. A needle is shown inserted through the dura and arachnoid into the subarachnoid space.

countered, the burr hole must be elongated anteriorly until the bluish-coloured dura has been exposed. The thickness of bone varies from one animal to another, but on the average, it measures one-quarter of an inch. Over the pituitary gland, the bone becomes much thinner, measuring about one-eighth of an inch in thickness. When the dura has been exposed, 5 c.c. of blood is taken from the femoral artery in a siliconed syringe. This syringe is attached to a polythene tube which, in turn, is attached to a No. 21 needle. The needle is then inserted through the dura while an assistant aspirates gently on the syringe (Figs. 4a and b). As soon as spinal fluid is obtained, the blood is injected into the subarachnoid space. When the injection has been completed, the small hole in the bone is filled with gel foam, and sealed by means of a plug of bone wax. The mucoperiosteum is then replaced, and the soft palate is sutured by means of a continuous running suture of plain catgut.

Results

The animals' clinical symptoms were recorded daily and the cerebrospinal fluid pressure was measured preoperatively and before sacrifice. Different animals were autopsied at 24, 48, 96 hours, one week, and two to three months postoperatively.

Fifty experiments were carried to completion. A successful subarachnoid hemorrhage without other existing pathology was achieved in 21 instances (Table I).

TABLE I.—Animals in Which Experiment was Completed

Number of animals in which experiment was completed	50
Successful cases	21
Failures	29

TABLE II.—Causes for Failure

Failures(29)	*Number of animals**	*Clinical symptoms*
Intraventricular hemorrhage	7	Three alive and well, three drowsy, one semi-comatose.
Trauma to third ventricle	8	Three alive and well, five sick.
Meningitis	7	Drowsy
Subdural hematomas	9	All alive and well
Complete failure to introduce any blood into subarachnoid space	4	Alive and well

*These figures add up to more than the total number of failures because some animals had more than one complication.

The causes for the 29 failures are listed in Table II. *Often* there was more than one cause for failure in these cases. It suffices to note here that of the nine cases with subdural hematomas all were alive and well. These cases then would tend to support the theory that 5 c.c. of blood should not act as a space-occupying lesion. The subdural hematomas were encountered in animals which were sacrificed in the first 96 hours and no chronic subdural hematomas were observed. It would appear that in these cases the bevel of the needle had not been inserted completely through the arachnoid membrane so that some of the blood escaped into the subdural space.

Not all of the animals in which a successful injection was carried out had the same amount of blood present in the subarachnoid space. A 1+ hemorrhage was used to designate a spread of blood around the optic nerves, chiasm, pituitary gland and proximal portions of the Sylvian fissures. A 2+ hemorrhage was of the same description but was thicker, with perhaps a thin staining over the brain stem. A 3+ hemorrhage was so classified when the blood spread out on to the hemispheral surface over the temporal lobes and along the base of the brain. The thickness of the blood clot was not used as a basis for grading. A 4+ hemorrhage showed extension into the cisterna ambiens, as well as over the base of the brain and on to the hemispheral surfaces (Figs. 7a and b). No satisfactory explanation was established to account for the variable amounts of subarachnoid blood when the same amount was injected in each case. Some loss may have occurred at the puncture site after the needle was withdrawn.

Among the 21 successful cases there was one death. The remainder survived until the time of sacrifice. Postoperatively, animals varied remarkably in their recuperative power and the clinical findings ranged from ataxia and drowsiness to semicoma (Figs. 5a and b). Ataxia in varying degree occurred after thiopental anesthesia in control animals, so we were unable to evaluate the significance of this sign. When drowsiness and semicoma occurred, it was out of proportion to the amount of anesthetic agent used and was therefore significant. It is noteworthy that the two animals which were semicomatose had a significant elevation of spinal fluid pressure and a 3+ or 4+ hemorrhage. On the other hand 3+ and 4+ hemorrhages were compatible with normal spinal fluid pressure and no signs or symptoms (Table III).

By and large the animals tolerated 5 c.c. of subarachnoid blood well. They tended to be sick for 24 hours but recovered quickly. Six of the 21 showed significant clinical

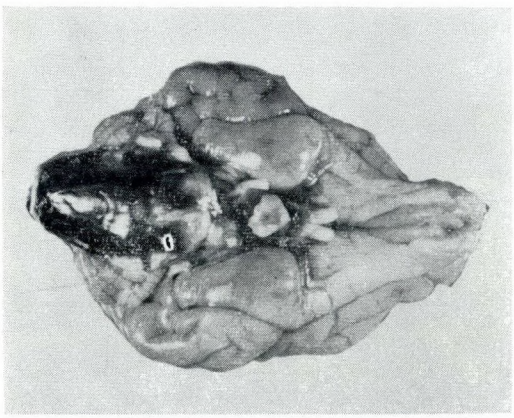

Fig. 5a.—Animal S.3—24 hours postoperatively, alive and well.

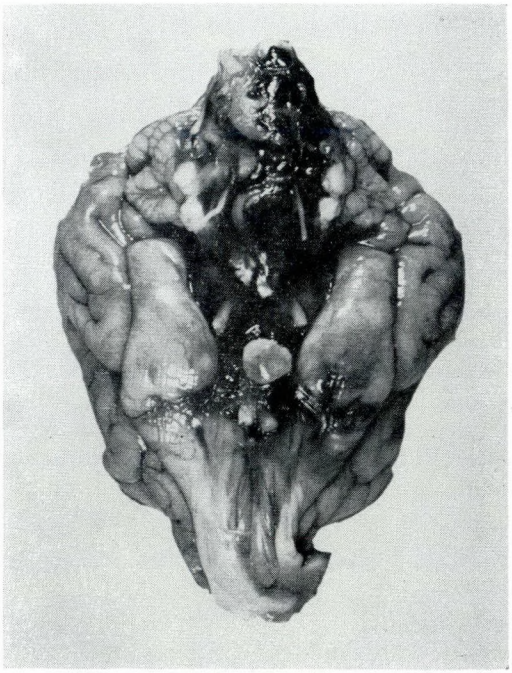

Fig. 5b.—Animal S.9—Comatose, 24 hours after injection.

TABLE III.—21 Dogs with Subarachnoid Blood Uncomplicated by Brain Injury or Sepsis

Hours	Case No.	Size of hemorrhage	C.S.F. pressure		Clinical	
			Preoperatively	Postoperatively		
	1	2+			Alive and well	
	8	2+	60	170	Drowsy	
	9	3+	60	360	Semicomatose	
	16	3+	95	140	Ataxia	
24	46	4+	80	120	Drowsy	
	54	4+	90	170	Alive and well	
	59	4+	90	240	Semicomatose	
	63	3+	60	90	Ataxia	
	30	4+	73	Died too quickly	Dead	
48	44	3+	90	120	Drowsy	
	3	3+	40	100	Alive and well	
72	19	3+	50	60	Alive and well	
	23	3+	120	120	" " "	
96	47	2+	30	80	Alive and well	
Three months	31	Evidence of old blood	N.M.*	110	Alive and well	
	32	"	88	60	" " "	
	33	"	98	110	" " "	Hydrocephalus
	34	"	92	112	" " "	Hydrocephalus
	37	"	84	105	" " "	
	53	"	82	94	" " "	
	57	"	88	92	" " "	

*N.M.—not measured.

symptoms. Only one animal died and autopsy failed to reveal any pathology other than the presence of subarachnoid blood.

Seven animals were sacrificed at two to three months – all of these animals were alive and well at the time. None had convulsions. Their spinal fluid pressures just before autopsy were normal. Two of these animals had hydrocephalus. Brain volumes were carried out according to the method of White[3] and no significant brain swelling was observed.

Pathology

Method.—At the time of sacrifice, colour photographs were made of the brain which was then weighed, and in 10 instances brain volumes were calculated using White's technique.[3] The brains of the 21 animals in which the experiments were defined as successful because of the uncomplicated introduction of blood into the subarachnoid space were studied, as well as the 29 brains from those in which the experiment was recorded as unsuccessful because of brain injury or the like.

The chief observations recorded on gross examination were the site and extent of subdural and subarachnoid hemorrhage, the presence of intraventricular hemorrhage or dilatation of ventricles and evidence of operative trauma to the brain or pituitary gland. In order to rule out the possibility of minute traumatic lesions close to the site of operation, sections of the pituitary gland and the floor and walls of the third ventricle were examined routinely. Other blocks were taken from the cerebral and cerebellar hemispheres and brain stems to determine the reaction of the leptomeninges to the presence of blood in the subarachnoid space. Stains used included hematoxylin and eosin, cresyl violet and Mallory's connective tissue and phosphotungstic and hematoxylin stains.

Pathological Observations

Gross.—The gross observations proved both interesting and useful and frequently were sufficient to distinguish the successful from the unsuccessful experiments. In seven instances, intraventricular hemorrhages were present and, as seen in Table II, in spite of the fact that hemorrhage was massive, three of the animals showed no clinical signs which would have led one to

suspect its presence (Fig. 2). On the other hand, three of the seven were drowsy and one was semicomatose.

A subdural hematoma was present in nine of the failures; all of these animals were alive and well to that time.

One of the fascinating features was the direction of spread of the blood in the subarachnoid space. It tended to extend from the site of injection around the pituitary stalk into the proximal portions of the Sylvian fissures, backward through the interpeduncular cistern and along the ventral surface of the brain stem. If a 4+ hemorrhage was achieved, the blood spread around the cerebral peduncles between the occipital lobes and cerebellum into the cisterna ambiens. This spread would therefore completely encircle the brain stem and fill this portion of the subarachnoid pathway necessary for the normal circulation of cerebrospinal fluid (Figs. 7a and b). Also in those with a 4+ hemorrhage, the blood would enter the cisterna magna from which, in two cases, it had extended upward through the fourth ventricle and aqueduct as far as the third ventricle. The other interesting feature was the large amount of subarachnoid blood which could be present without causing symptoms (Fig. 8). If the animals were not sacrificed until many weeks after the injection, the only remaining evidence of subarach-

Fig. 7a.—Cross section of dog's brain stem from the interpeduncular fossa to the cisterna ambiens. A collar of blood completely encircles the brain stem.

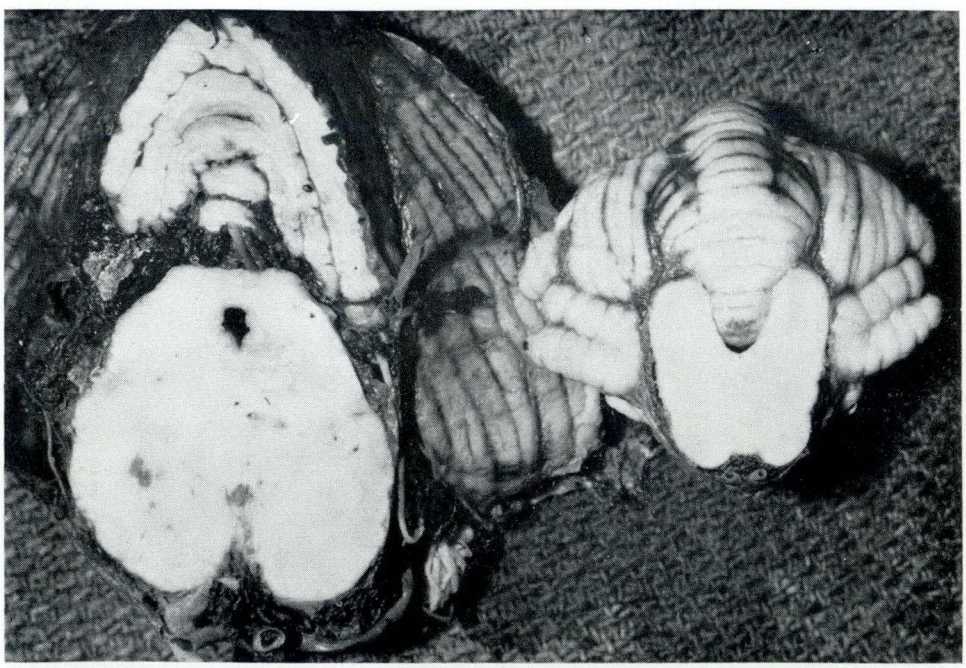

Fig. 7b.—The comparison of a human brain stem with a collar of blood surrounding it on the left, with the dog brain stem on the right.

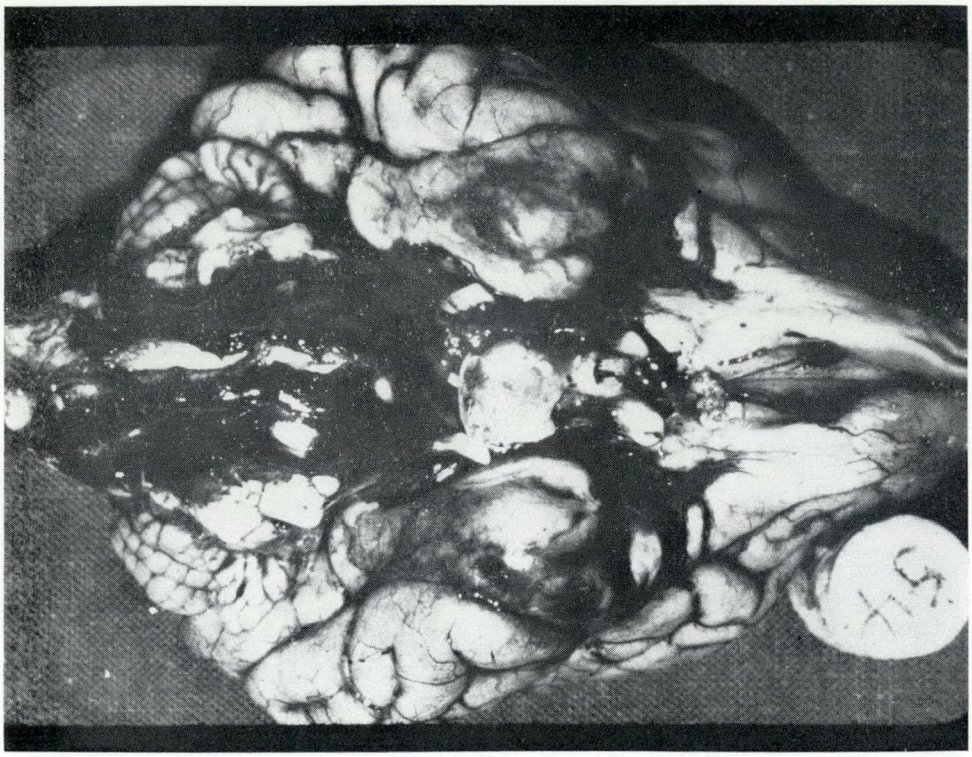

Fig. 8.—A 4+ hemorrhage showing the spread of blood over the base of the brain on to the temporal lobes and around the brain stem. This animal was alive and well despite the extensive subarachnoid hemorrhage.

noid hemorrhage was a faint staining of the brain; there was no evidence of adhesions. In two cases hydrocephalus was present (Fig. 9) but we have encountered this finding in so-called normal animals and do not feel that we have statistical evidence of significance in these experiments.

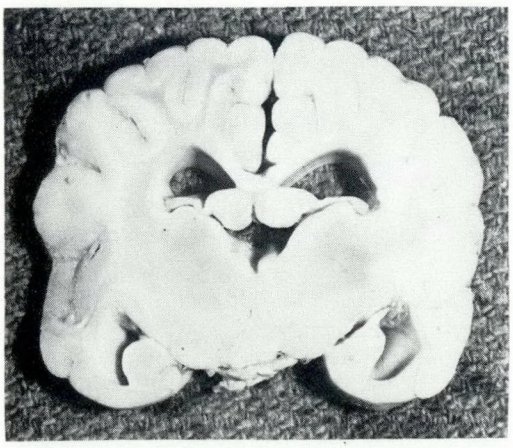

Fig. 9.—This coronal section through the lateral ventricles and tips of the temporal horns shows the extent of hydrocephalus which was present.

Microscopic studies proved very helpful in detecting less obvious failures in the technique. Of the eight cases excluded because of trauma to the region of the third ventricle, three had lesions unsuspected on gross examination. The lamina terminalis was involved in one case and the pituitary gland in two. These lesions were small softenings not associated with intraventricular hemorrhage. Acute meningitis was diagnosed in seven other animals as the polymorphonuclear reaction in the subarachnoid space was much more intense than would be expected if it had been due solely to the presence of blood: these also were excluded.

In the successful cases, microscopic examination showed a moderate polymorphonuclear reaction in the subarachnoid space 24 hours after the injection of the blood. By 72 hours macrophages were present, some of which contained blood pigment

and by the end of a week most of the cells were macrophages. During this period, the fibroblasts in the subarachnoid space showed an increase in size and numbers but this increase was very slight and was not considered to be of any significance. The presence of an occasional hemosiderin-laden macrophage in the leptomeninges accounted for the slight staining of the brain noted in the long term experiments. No significant arachnoid fibrosis was seen in these animals. There was no microscopic evidence of cerebral edema. This finding was supported by the estimations of brain volume.[3] Two small craniopharyngiomas were incidental findings.

Discussion

It would at first seem that 21 successes out of 50 attempts to introduce blood into the subarachnoid space is a discouraging rate. However, in only four of the 50 cases did blood actually fail to enter the subarachnoid space. The failures were occasioned in some instances by minute lesions in the floor of the third ventricle which in several instances caused no clinical symptoms. Other "failures" were so classified because they were complicated by additional, associated lesions.

The survival rate in animals following the uncomplicated introduction of blood into the subarachnoid space is excellent; only one animal died in a series of 21 experiments. The capacity of some animals to tolerate a 4+ subarachnoid hemorrhage or even a gross intraventricular clot without exhibiting any signs or symptoms was indeed surprising (Figs. 6 and 8). However, when the cerebrospinal fluid pressure was significantly elevated, as in cases 9 and 59 (Table III), a 3+ or 4+ hemorrhage was present and the animals were semicomatose. Since none of these animals exhibited a marked cellular response in the leptomeninges to the presence of blood, and since cerebral edema was discovered in no case either by estimation of brain volume or by microscopic studies, it seems fair to assume that the raised cerebrospinal fluid pressure was caused by some factor other than brain swelling. The cause of the increased spinal fluid pressure in these animals has not been established. It is possible that the mode of distribution of the hemorrhage in the subarachnoid space could explain this increase in spinal fluid pressure. We have been impressed by the collar of blood which forms around the brain stem from the interpeduncular fossa ventrally, to the cisterna ambiens dorsally. This occurs at the level of the free margin of the tentorium, and might partially or in some cases completely obstruct cerebrospinal fluid circulation and hence cause elevation of the spinal fluid pressure. This pattern of spread of blood is encountered in patients dying from subarachnoid hemorrhages. Fig. 7b demonstrates the similarity between the human brain with a subarachnoid hemorrhage and the experimental hemorrhage in a dog. This collar of blood might offer an explanation for the onset of acute hydrocephalus which is so frequently encountered in cases of subarachnoid hemorrhage in humans.

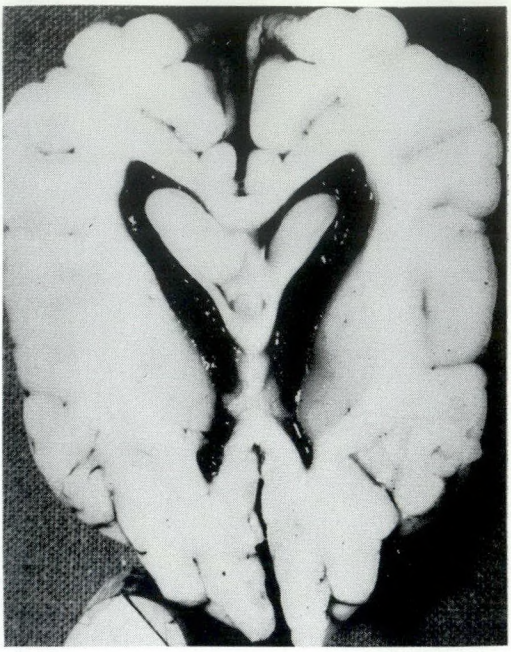

Fig. 6.—This horizontal section through the cerebral hemispheres shows an intraventricular clot, in spite of which the animal was alive and well.

Summary

A method of introducing blood into the subarachnoid space has been described.

The method was successful in 21 of 50 experiments.

A significant rise in cerebrospinal fluid pressure was observed in animals that were semicomatose.

There was no evidence that the presence of subarachnoid blood caused cerebral edema.

It is speculated that spinal fluid pressure changes and clinical symptoms might be explained by acute blockage of the cerebrospinal pathways.

A mechanism for acute blockage of cerebrospinal fluid pathways is suggested from the pathological findings.

ACKNOWLEDGMENTS

The authors wish to thank Dr. E. H. Botterell for his help and advice. We are indebted to Mr. R. Jones and Mr. H. Lane for the photographs taken in the preparation of this paper, and to Miss E. Trites for her help in the preparation of the manuscript.

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RÉSUMÉ

Le présent article se propose d'étudier les effets de l'introduction de sang artériel dans l'espace sous-arachnoïdien dans la région du polygone de Willis, chez le chien. Le but de ces expériences est de mieux comprendre ce qui arrive dans les ruptures anévrysmales.

Ces essais ont été conduits chez des chiens de 20 kg. à 30 kg., dont le comportement était soigneusement étudié avant l'intervention. Après anesthésie au pentothal intraveineux, la pression du liquide céphalo-rachidien fut mesurée. La voie d'accès vers l'espace sous-arachnoïdien choisi fut la voie orale, par laquelle on traverse le palais puis la cavité nasale, au fond et en haut de laquelle on peut alors trépaner la base du crâne; on prépare ensuite une seringue, contenant 5 c.c. de sang, munie d'une aiguille N° 21. On peut de cette façon ponctionner les méninges à travers le trou de trépan. Cette ponction doit être faite avec précaution et lorsque l'on peut aspirer du liquide céphalo-rachidien, on est sûr de se trouver en bonne place: on injecte alors le sang.

Dans ces conditions, on réussit à reproduire une hémorrhagie sous arachnoïdienne dans 21 cas. Les animaux furent étudiés soigneusement quant à leur comportement et quant aux variations de pression de leur liquide rachidien. Ils furent sacrifiés après des périodes variant entre 24 heures et trois mois.

Les auteurs discutent un mécanisme pouvant conduire à un blocage subit de la circulation du liquide rachidien, blocage qui serait susceptible d'expliquer certains symptômes observés.

MAN'S POSTURE: ELECTROMYOGRAPHIC STUDIES. J. Joseph, M.D., M.R.C.O.G. Reader in Anatomy, Guy's Hospital Medical School, London. Introduction by H. Jackson Burrows, M.A., M.D., F.R.C.S. 88 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $6.00.

This is another splendid book by the Charles C Thomas Publishing House in the monograph series of the American Lectures on Orthopædic Surgery.

Dr. Joseph has chosen to study man's posture within the normal range and has produced a provocative challenge to the common concept of muscle balance in maintenance of posture. The evidence in favour of the role of the ligaments of the knee and the upright posture when the subject is "standing at ease" is very convincing. At the ankle joint, the role of the calf muscles, mainly the soleus, is supported by the study. At the hip joints, the ligaments appear to be the principal factors in stability when the hips are in the extended position.

The author's definition of muscle tone is of particular interest to the clinical teacher. It is suggested that the term should be discarded, or should refer only to the response of skeletal muscle to stretch.

This study with surface electrodes and a suitable amplifier to accommodate the frequency ranges is outlined in detail. The clarity of this presentation makes it a worth-while book in the library of all students of human posture.

The index and bibliography are excellent.

THE ANATOMICAL PATHOLOGY OF EXPERIMENTAL GALLBLADDER CARCINOMA IN HAMSTERS*

G. O. BAIN, M.D.† and K. KOWALEWSKI, Ph.D., M.D.,‡ *Edmonton*

ACCORDING TO Arminski[1] carcinoma of the gallbladder in man is a rare disease having a crude incidence of 0.43% of cadavers. On the other hand, Steiner,[16] in 1942, calculated that any single epithelial cell in the biliary system has a greater chance of becoming cancerous in the life span of the individual than any other cell of the body, except perhaps those of the uterine cervix. Powerful influences must be operative to account for such an exceptional neoplastic propensity. Most discussions of the etiology of cancer of the gallbladder in humans have centred about the high incidence of gallstones in association with cholecystic malignancy. Over the years, many attempts have been made to induce gallbladder carcinoma in experimental animals by the use of gallstones originating either in benign or malignant human gallbladders. In 1933, Burrows[5] reviewed the earlier literature on the effects of placing various foreign bodies in the guinea pig gallbladder and also reported experiments in which gallstones from non-malignant human cases were implanted in the gallbladders of 33 guinea pigs. He interpreted his own results and those of previous workers as having produced only cholecystitis glandularis proliferans. In the same year, Petrov and Krotkina[15] of Leningrad claimed to have produced carcinoma of the gallbladder in guinea pigs by the introduction into the lumen of glass tubes, which in some experiments contained radium. After the second world war, the same authors published further documentation of this experiment.[15] An attempt to reproduce these results in the United States was unsuccessful.[7] The guinea pig gallbladder seems to be exceptionally resistant to the induction of neoplasia. Because of the convertibility of bile acids and cholesterol to methylcholanthrene by chemical processing, the possibility that some chemical carcinogen of phenanthrene type may be secreted in the bile has been considered in the etiology of neoplasia in the biliary tract.[13] We therefore conducted observations on 60 guinea pigs with intracholecystic methylcholanthrene pellets for over 500 days from 1954 to 1956, and found only cholecystitis glandularis proliferans.[19] In the meantime, Fortner[10] produced gallbladder cancer in cats by this technique but, as in the Russian work, the time required was long and the number of animals with tumours was small. We have found the golden hamster a more satisfactory experimental animal for this purpose. In 1958 we reported the occurrence of gallbladder carcinoma in a high proportion of hamsters within eight months following intracholecystic implantation of methylcholanthrene pellets.[3]

The present report deals with new experimental material, confirming and extending our previous observations, with emphasis on the anatomical pathology of experimental carcinoma of the gallbladder.

Fig. 1.—Large gallbladder carcinoma which has invaded and replaced part of the liver: 256 days after pellet implanted (Group C).

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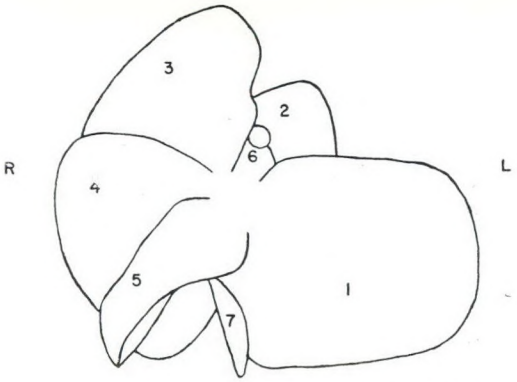

Fig. 2.—Numerals used to identify lobes of hamster liver: caudal surface.

Materials and Methods

Pellets were prepared by melting methylcholanthrene with heat and drawing it into a glass tube of 1 mm. bore. After cooling, the solid methylcholanthrene cylinder was pushed out of the tube and cut into pieces 2 mm. long, each piece weighing from 6 mg. to 8 mg.

The experimental animals were male golden hamsters approximately three months of age, fed on Miracle Rabbit Pellets with water and fresh carrot *ad libitum*. All surgical procedures were carried out under sodium pentobarbital anesthesia (30 mg./kg. body weight). The animals were divided into three groups. The members of group A received single intracholecystic methylcholanthrene pellets implanted by trocar. In group B, the same procedure was carried out, with, in addition, ligation of the cystic duct. In group C, pellet implantation and cystic duct ligation were combined with dissection of the gallbladder from its bed.

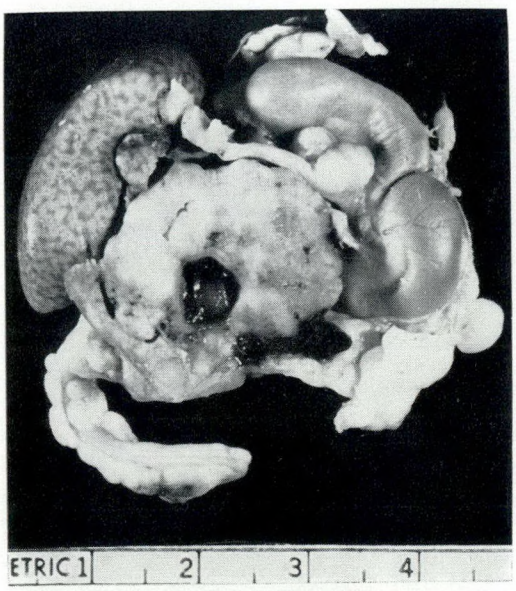

Fig. 3.—Carcinoma of gallbladder with residual distended lumen. Tumour has spread to lesser curvature of stomach and mesentery: 288 days after pellet implanted (Group C).

Fifty-four of the 59 experimental animals died spontaneously, the other five being sacrificed. All animals were submitted to autopsy examination of thoracic and abdominal viscera. The tissues were fixed in 10% formalin and sectioned in paraffin. All tissues were stained with hematoxylin and eosin and selected sections were also stained by van Gieson, Foot's reticulum and Congo red methods. Certain of the tumours were transplanted by trocar to the cheek pouches of normal hamsters.

Results

Over 70% of the experimental animals developed carcinoma of the gallbladder within 400 days of implantation of the pellet. In hamsters surviving over 140 days after pellet implantation, the tumour incidence was 77%, and after 240 days it was 81%. There was no significant difference in tumour incidence in the three groups.

Because, in the past, the results of much experimental work have been vitiated through the interpretation of cholecystitis glandularis proliferans as adenocarcinoma, it is essential to discuss the criteria used for the diagnosis of carcinoma in this study. The histological criterion upon which we have placed the greatest reliance is true tumour invasion. In cholecystitis glandularis proliferans, one may observe extensive penetration of pericholecystic tissues by proliferating glandular structures. This does not, however, represent true invasion but rather a herniation of tubular mucosal processes through the muscle. This type of benign glandular invasion therefore represents an extension of the lumen into the gallbladder wall or into surrounding structures. The process rarely extends into contiguous liver and even when it does so, fibrous tissue precedes it. Neoplastic inva-

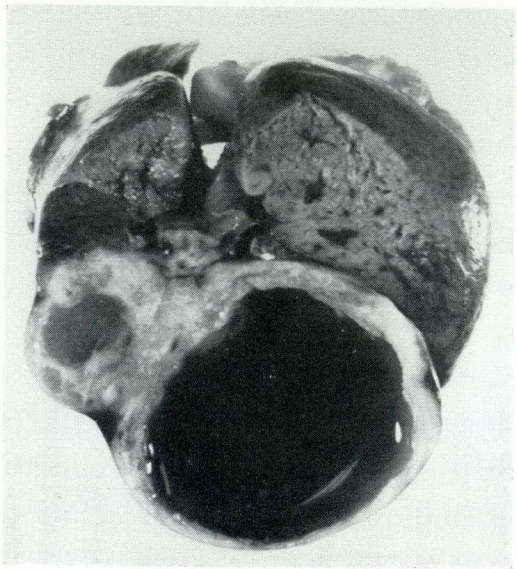

Fig. 4.—Mucocele surrounded by tumour: 256 days after pellet implanted (Group C).

sion, on the other hand, represents a budding-off from the epithelial gallbladder lining and may or may not carry processes of the lumen with it. Although there may be concomitant fibrous proliferation in the gallbladder wall, the neoplastic epithelium is not bound by it but infiltrates through it.

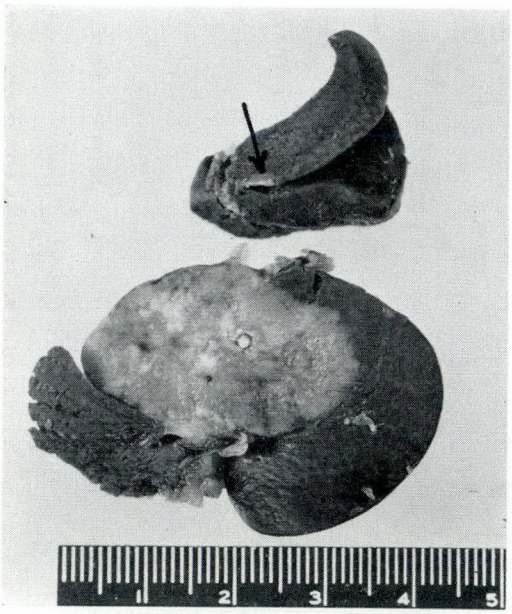

Fig. 5.—Methylcholanthrene pellet embedded in solid tumour. Arrow indicates small subcapsular metastasis: 346 days after pellet implanted (Group C).

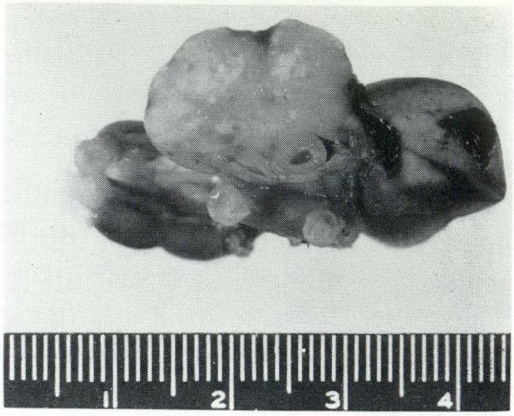

Fig. 6.—Gallbladder carcinoma partly surrounding and invading intestine: 327 days after pellet implanted (Group A).

Because of the rigid application of these criteria it is possible that "precancerous" lesions and a few early carcinomas have been excluded. In addition, three non-invasive papillomas of the gallbladder found in groups A and B, 189, 371 and 327 days after pellet implantation have been excluded in calculating the tumour incidence. Two of these (those detected after 371 and 327 days) showed marked cellular hyperchromatism and atypicality in the papilloma and also the entire gallbladder mucosa.

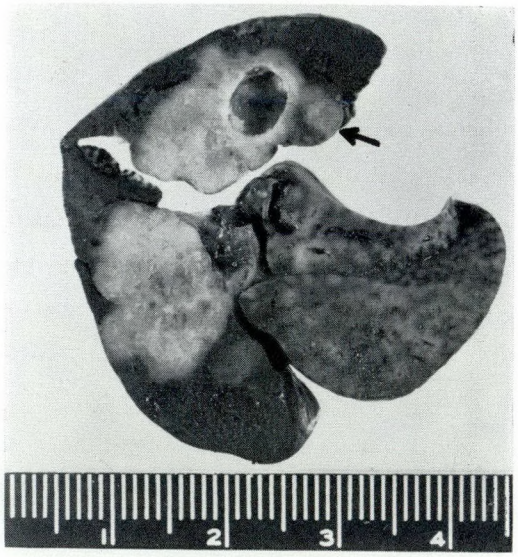

Fig. 7.—Gallbladder adenocarcinoma invading liver. Distended residual lumen has been emptied. Arrow indicates hepatoma-like nodule seemingly in collision with gallbladder carcinoma: 356 days after pellet implantation (Group C).

Gross Pathology.—The smallest tumours recognized grossly consisted of friable white tissue filling the gallbladder lumen or a solid grey-white mass replacing the organ. In some instances the early tumour formed a thickening or a mass in the wall of the gallbladder. This was seen particularly in animals in which the cystic duct had been ligated, with resulting dilatation of the gallbladder. Larger tumours formed nodular, firm masses bulging from the liver and often replacing much of that organ (Fig. 1). We have identified the lobes of the hamster liver by number (Fig. 2). Lobes 2 and 6 were often entirely replaced by tumour. Lobe 3 was frequently extensively invaded and often replaced. Lobes 1 and 4 were commonly invaded by tumour but even with the largest neoplasms peripheral portions remained. Lobes 5 and 7 were rarely involved. Often the original gallbladder lumen remained either as a cystic bulge on the caudoventral aspect of the tumour or a cyst deep within the tumour filled with green gelatinous or brownish green pultaceous material containing the pellet (Fig. 3). No calculi were found in any of the gallbladders. In animals in which the cystic duct had been ligated the gallbladder lumen was occasionally greatly distended with clear, viscid, mucoid fluid (hydrops or mucocele) as seen in Fig. 4. In other instances no lumen remained, the pellet being incarcerated in tumour tissue (Fig. 5). The cut surfaces of most tumours were grey-white, yellow to green icteric staining being evident in some instances. Necrosis and hemorrhage were common in large tumours and areas of mucoid character were occasionally seen. Many of the larger tumours surrounded and invaded adherent loops of intestine (Fig. 6). In some such instances the stomach and duodenum were greatly dilated at the time of death. One tumour contained a peripheral brownish-pink nodule which resembled hepatocellular carcinoma microscopically (Fig. 7). The remainder of this tumour was pure biliary adenocarcinoma.

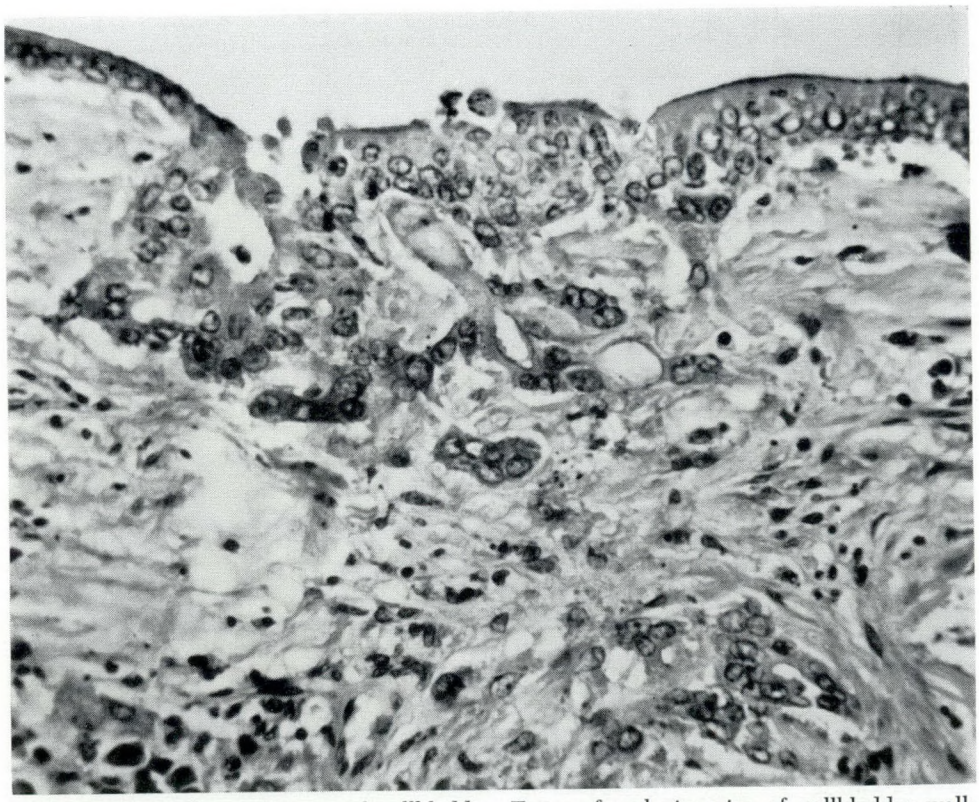

Fig. 8.—Adenocarcinoma of gallbladder. Focus of early invasion of gallbladder wall: 142 days after pellet implanted (Group B; H & E, original magnification x 225).

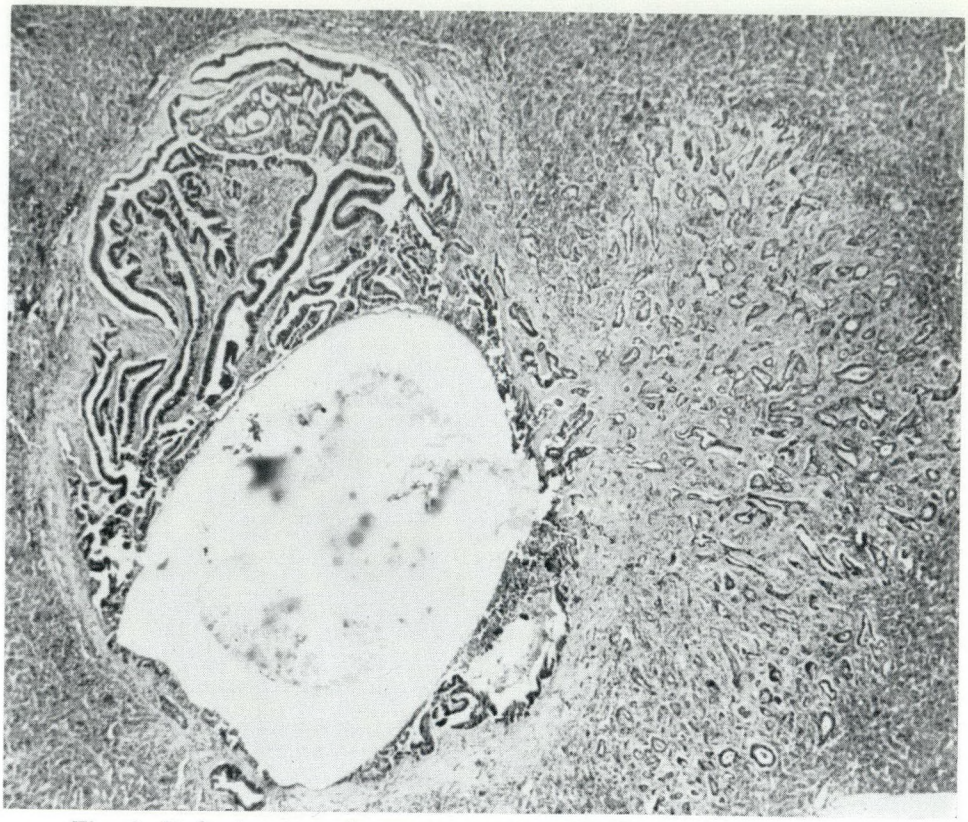

Fig. 9.—Early invasive adenocarcinoma of gallbladder. Lumen occupied by pellet and papillary mucosal proliferation. Tumour invades liver in right-hand side of photograph: 113 days after pellet implanted (Group A; H & E, original magnification x 22.5).

Histopathology.—The earliest epithelial alteration observed in a hamster gallbladder containing a methylcholanthrene pellet was hyperchromatism and anisokaryosis. Sometimes this stage proceeded directly to true invasion of the wall without significant intraluminal growth (Fig. 8). In other instances mucosal epithelial proliferation resulted in pseudostratification and papillary tufting. With further growth, the expanding mucosa was accommodated by complex convolution, resulting in extensive papillary ingrowth and peripheral gland-like outpouching. In this process, the gallbladder architecture was disorganized and the lumen reduced and subdivided. Sometimes the lumen was represented only by the space occupied by the pellet. At the same time, adenocarcinomatous invasion of the adjacent hepatic tissue occurred at one or many points on the circumference of the gallbladder (Fig. 9). In a few instances it was noted in animals in which the cystic duct had not been ligated that the mucosal epithelium of the cystic duct showed proliferation and considerable hyperchromatism and atypia. In one animal the cystic duct was the site of early invasive adenocarcinoma while the lining of the gallbladder proper, although markedly atypical, was noninvasive. It is possible that neoplastic transformation of the extrahepatic bile ducts may have occurred in other animals but was not demonstrable because of incorporation in large tumour masses replacing these structures as well as the gallbladder and much of the liver.

Ninety per cent of the tumours were pure adenocarcinomas, the majority of which were well differentiated (Figs. 10 and 11). Most tumours contained intermediate, small and large glands in varying proportions. In some instances large irregular ductlike structures were prominent (Fig. 12). Papillary formations were common, particularly in association with large gland

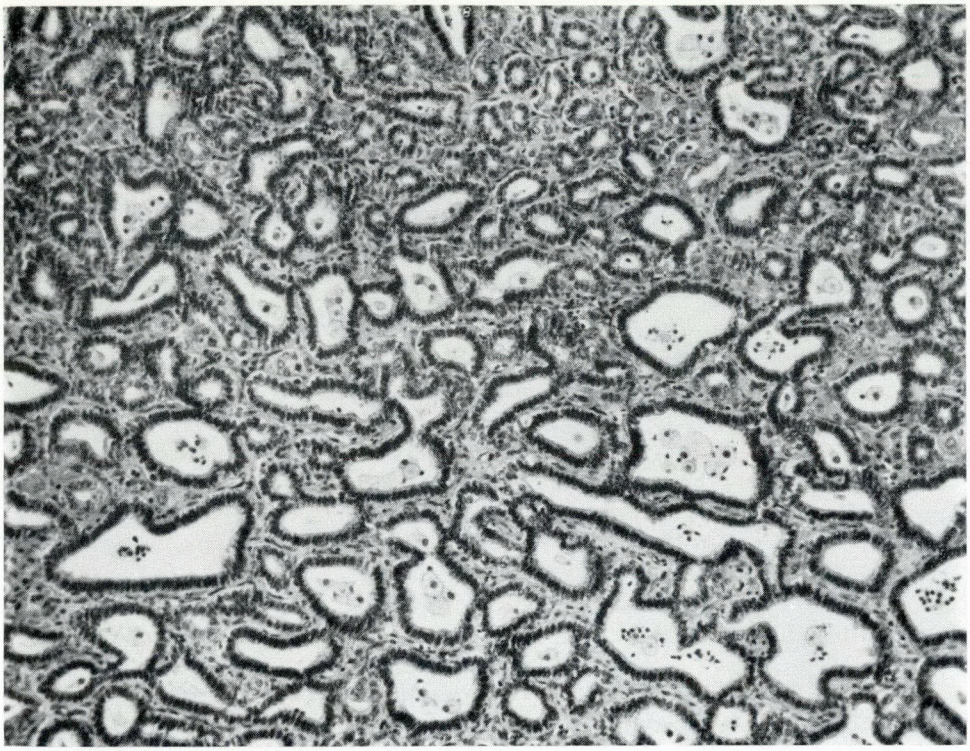

Fig. 10.—Adenocarcinoma of gallbladder: 230 days after pellet implanted (Group C; H & E, original magnification x 90).

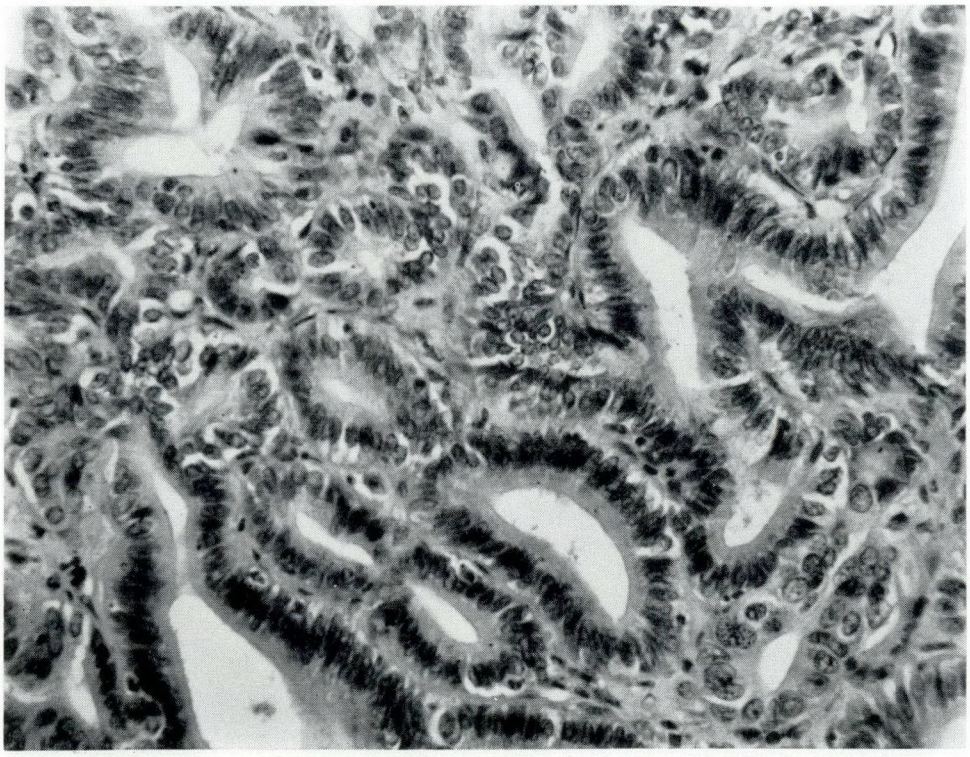

Fig. 11.—Adenocarcinoma of gallbladder: 327 days after pellet implanted (Group A; H & E, original magnification x 225).

or cystic structures. Some tumours contained many mucous goblet cells (Fig. 13). A few of the tumours were poorly differentiated, consisting of sheets of large cells, often with vacuolated cytoplasm, showing little tendency to form glandular or duct structures (Fig. 14). An occasional tumour displayed a sarcomatous type of stroma such as is sometimes seen in experimental hepatoma. In such instances malignant papillary or glandular structures were intimately associated with the sarcomatous type of tumour tissue (Fig. 15). Three tumours were encountered which contained large undifferentiated cells reminiscent of neoplastic liver cells. In one instance the large cells were intimately associated with an adenocarcinomatous component (Fig. 16). In the other two hamsters the large cell components appeared to be in collision with biliary adenocarcinoma of the usual type.

In the hepatic tissue a short distance beyond the invading margins of several of the tumours it was noted that portal bile ducts were lined by hyperchromatic, atypical epithelium. In some instances such ducts were considerably enlarged and apparently empty. Atypical portal bile ducts were rarely seen at any great distance from the tumour. In a few animals examination of the infiltrating tumour margin at its junction with surviving hepatic tissue led to the impression that tumour infiltration, where it met portal triads, progressed slightly in advance of intralobular tumour infiltration. The significance of this observation is not clear as it was not possible to find convincing morphological evidence that tumour infiltration in portal regions progressed by neoplastic transformation of existing portal bile ducts. Nor could this possibility be entirely eliminated.

Both neoplastic and non-neoplastic gallbladders containing methylcholanthrene pellets showed evidence of cholecystitis in the form of lymphocytic and plasma cell infiltration of the wall, often with pus in the lumen. There was commonly loss of muscular tissue with fibrosis and hyaliniza-

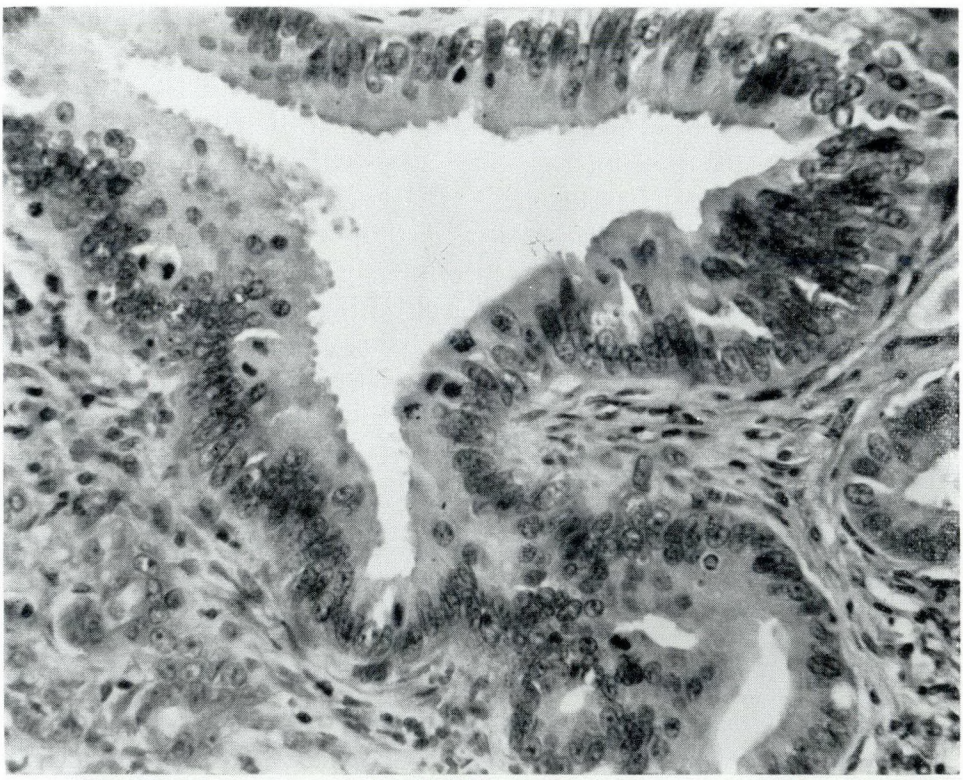

Fig. 12.—Adenocarcinoma of gallbladder, large duct pattern: 327 days after pellet implanted (Group A; H & E, original magnification x 225).

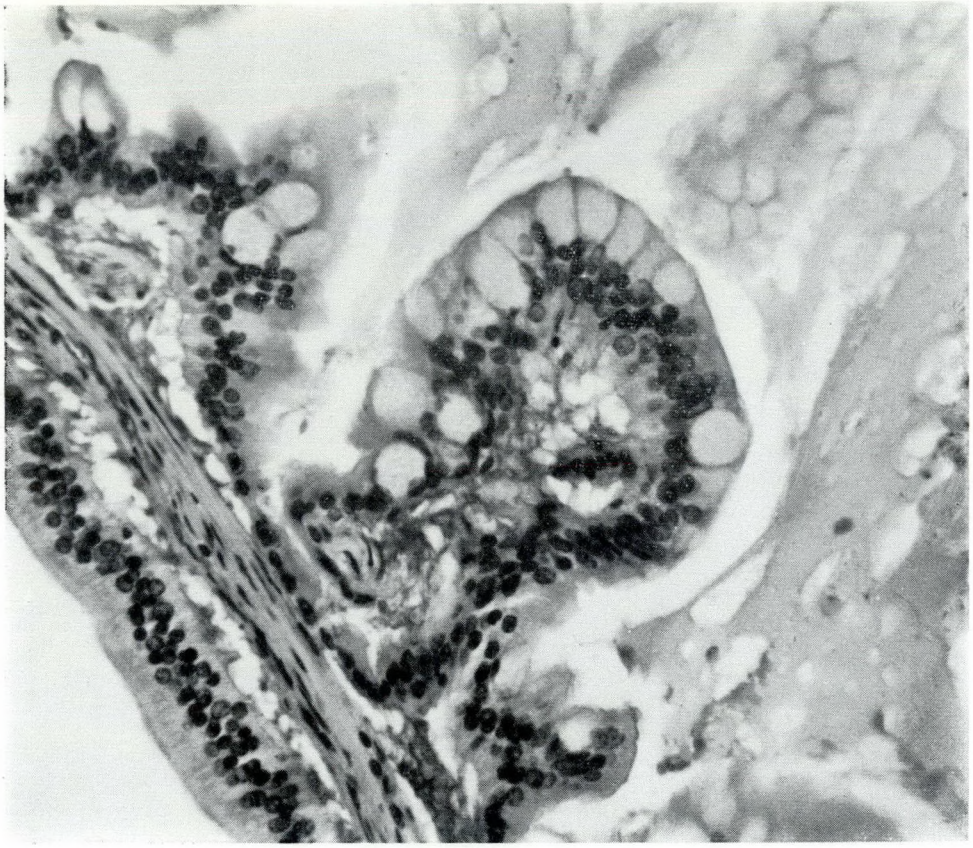

Fig. 13.—Adenocarcinoma of gallbladder. Papillary cystic pattern with mucous goblet cell: 366 days after pellet implanted (Group A; H & E, original magnification x 225).

tion of the wall. In large tumours portions of tumour stroma, especially in the region of the residual gallbladder lumen, often showed similar hyalinization. Extensive necrosis was common in such regions. These inflammatory and degenerative phenomena appear to be a response of mesenchymal tissues to methylcholanthrene. The epithelium of the gallbladder mucosa, although intimately exposed to the methylcholanthrene pellet, did not show this type of reaction but underwent atypical hyperplasia and neoplastic transformation.

In non-neoplastic gallbladders and also in those with small carcinomas there was a proliferation of small bile ducts and occasionally of "oval cells" (*vide infra*) in the gallbladder bed of the liver. Some large tumours showed, in some areas, three more or less distinct zones: a layer of proliferating malignant epithelium lining and projecting into the gallbladder lumen, peripheral to which was hyalinized gallbladder wall containing comparatively little tumour, beyond which was a broad zone of adenocarcinoma invading the liver. This raised a question as to whether the invasive tumour tissue may have arisen from small proliferating bile ducts such as have been observed in the bed of "precancerous" gallbladders and those containing early carcinomas. However, invasion of some portions of the gallbladder wall by malignancy arising in the mucosa could be demonstrated in every tumour in which gallbladder remnants could be identified. Furthermore, study of tumours in various stages of their evolution produced no convincing evidence of malignancy arising in bile duct proliferation in the gallbladder bed.

Tumour Spread.—Vascular invasion was observed in 50% of the tumours (Fig. 17). Excluding hepatic invasion, direct invasion

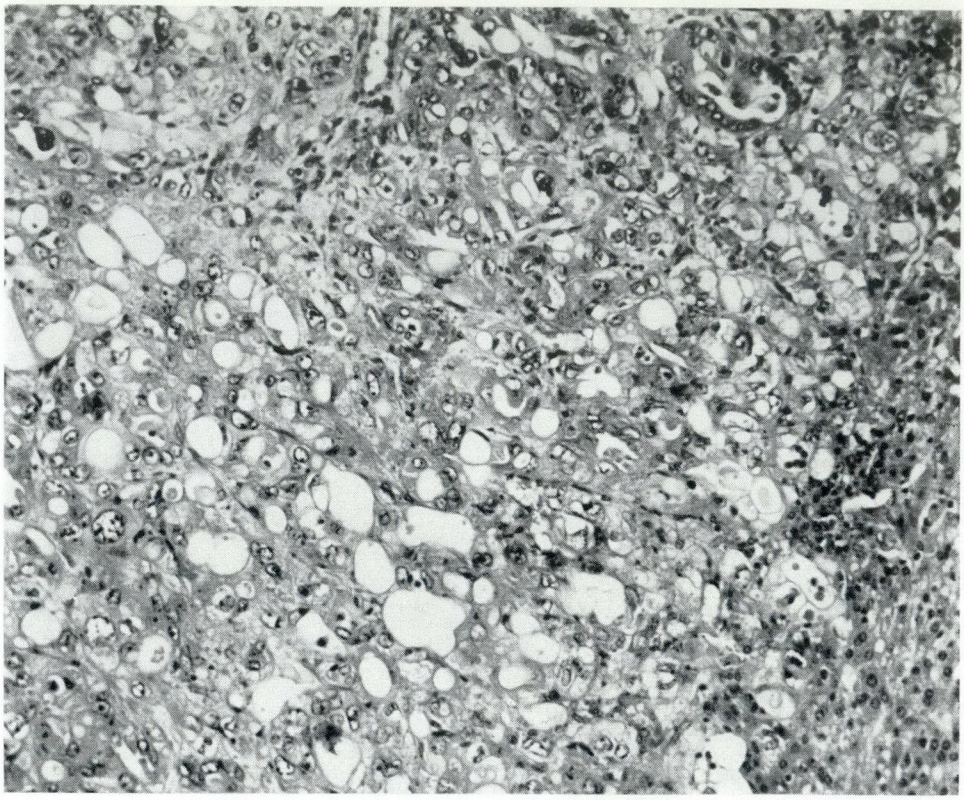

Fig. 14.—Undifferentiated adenocarcinoma of gallbladder invading liver: 168 days after pellet implanted (Group C; H & E, original magnification x 90).

of structures adjacent to the tumour was present in 48%. Structures invaded included the diaphragm (Fig. 18), adherent bowel (Fig. 6), gastro-hepatic ligament (Fig. 19), pancreas and lower thoracic wall. In an occasional animal, intra-abdominal tumour spread was so extensive as to constitute peritoneal carcinomatosis.

Metastases were observed in association with 29% of the tumours. Sites of metastatic tumour included abdominal and mediastinal lymph nodes (Fig. 19), the liver distant from the primary tumour (Fig. 20), the peritoneum, the gastric wall, the diaphragm and the lungs (Fig. 21) and pleura. In a few instances perineural lymphatic metastases were seen. The earliest metastases observed were found in a hamster dying 168 days after pellet implantation.

Transplantation.—One tumour selected at random from each of the three experimental groups was transplanted by trocar into the cheek pouches of normal hamsters. A total of 17 transplants were made. Four of the six transplants from the group A tumour "took"; seven of the eight transplants from the group B tumour "took", and all three transplants from the group C tumour "took". They showed slow but progressive growth requiring about 10 weeks to reach a diameter of 0.5 cm. to 1.0 cm. Some of the transplanted tumours grew as solid nodules (Fig. 22), but others formed rapidly enlarging multicystic structures. Seven of the transplanted tumours have been retransplanted to fresh hamsters with four "takes".

Other Lesions.—A variety of hepatic alterations accompanied many of the tumours of the gallbladder. Hepatic necrosis of variable distribution and degree occurred in 19 animals. Eosinophilic central lobular necrosis was most common, but midzonal, peripheral and focal necroses were also observed. In a few instances massive necrosis of a lobe was clearly associated with invasion and isolation of

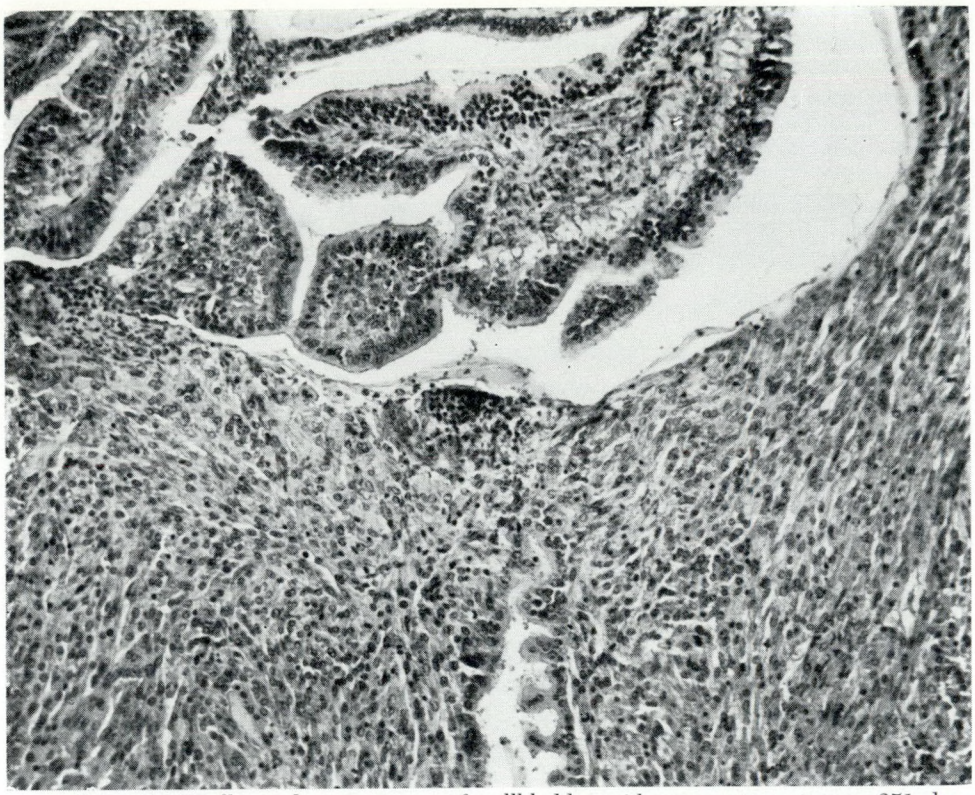

Fig. 15.—Papillary adenocarcinoma of gallbladder with sarcomatous stroma: 351 days after pellet implanted (Group C; H & E, original magnification x 90).

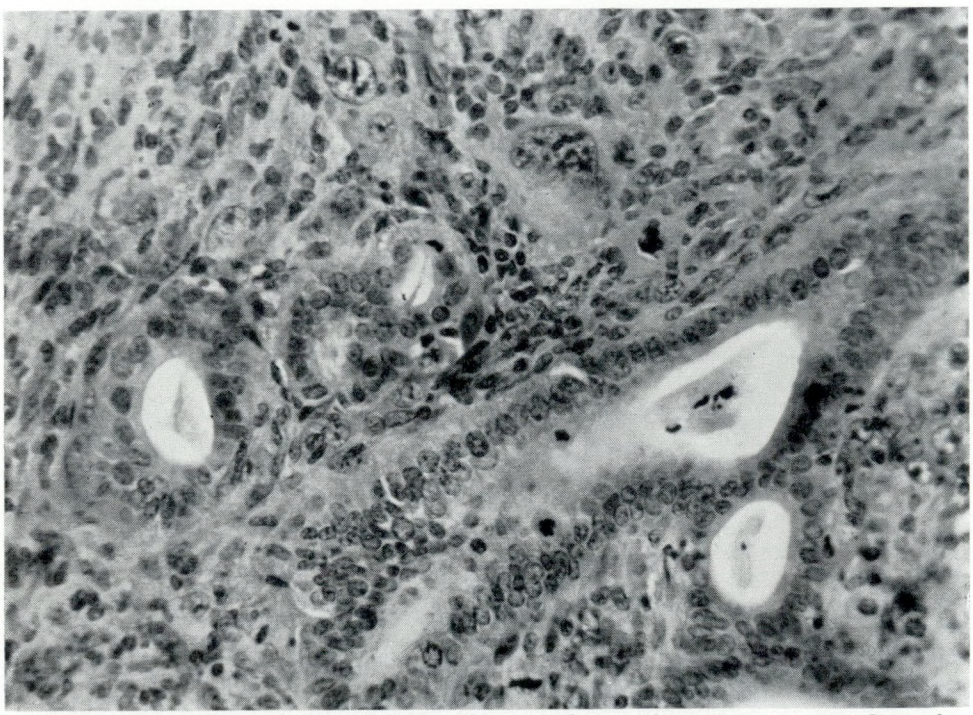

Fig. 16.—Adenocarcinoma of gallbladder with large cell components: 327 days after pellet implanted (Group A, H & E, original magnification x 225).

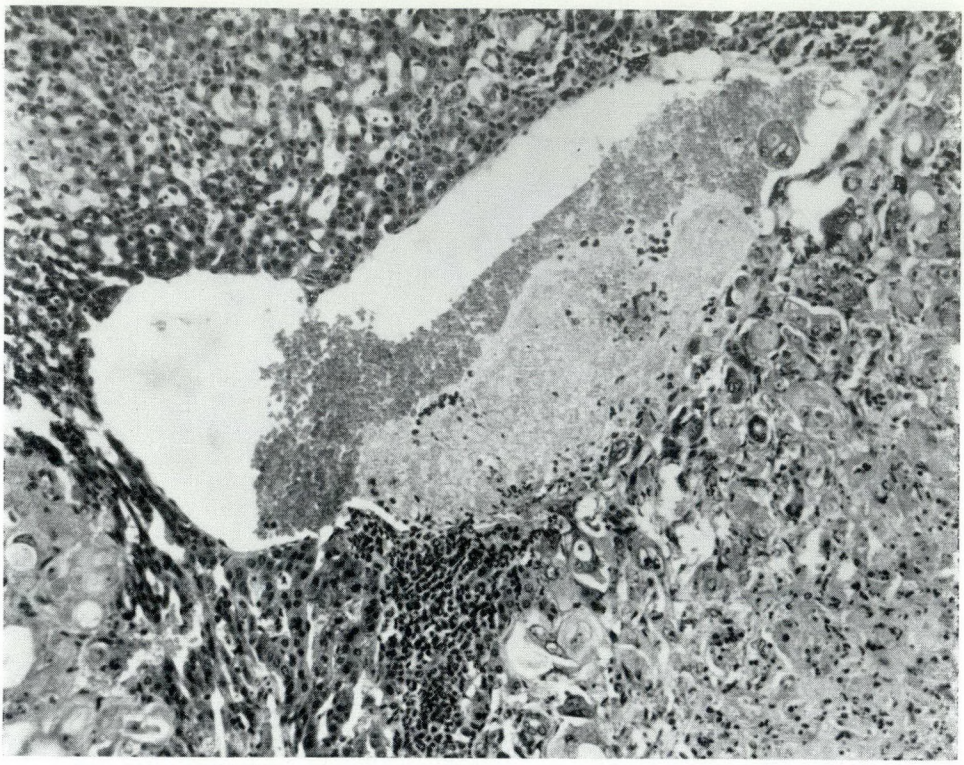

Fig. 17.—Gallbladder carcinoma invading an hepatic vein: 168 days after pellet implanted (Group C; H & E, original magnification x 90).

the lobe by tumour. In many instances necrosis was accompanied by proliferation of pale, oval cells in portal regions (Fig. 23) but the latter also occurred in the absence of hepatic necrosis. In four instances there occurred portal alterations better described as bile duct proliferation with fibrosis. These animals all had gallbladder carcinomas. As in the cholangiofibrosis associated with hepatic carcinogenesis in rats from azo-dye feeding, the newly formed ducts were somewhat atypical (Fig. 24). Twelve livers contained cystic lesions resembling those described in rats fed carcinogenic dyes. In four instances cystic lesions were found in animals without tumours. Most were subcapsular but a few were adjacent to the gallbladder and in one instance the cysts were shown to communicate with the gallbladder lumen. The linings of these cysts are consistent with an origin from biliary epithelium (Fig. 25). In a few instances cystic lesions were contiguous with gallbladder carcinomas but the significance of this is not clear. In several animals mild amyloid deposition was seen in the liver, affecting particularly the subendothelium of hepatic veins. Amyloid was not demonstrated in other organs. The mucosa of the gastrointestinal tract showed no important abnormalities except for the instances in which the gut was the site of direct tumour invasion or metastasis. In a few animals there appeared to be a definite increase in the number of mitotic figures in the mucosal crypts of the small intestine but no primary tumours were seen.

In view of presumptive evidence presented by Dauben and Maybee[6] that C^{14}-labelled methylcholanthrene injected subcutaneously is excreted in the feces, probably by way of the biliary tree, it seemed possible that the various hepatic lesions observed may have resulted from an enterohepatic circulation of methylcholanthrene originating from the pellet.[3] Therefore, in 38 hamsters, after implantation of the pellet, the cystic duct was ligated with or without freezing the gallbladder from its

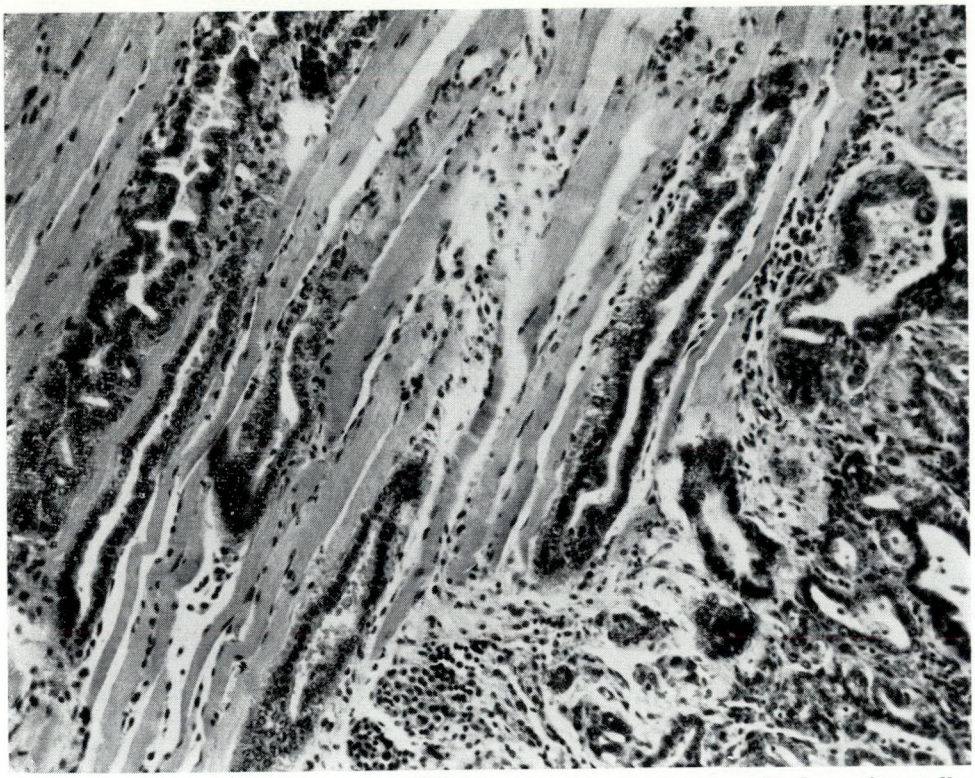

Fig. 18.—Adenocarcinoma of gallbladder invading diaphragm: 230 days after pellet implanted (Group C; H & E, original magnification x 90).

bed (groups B and C). This procedure did not modify the incidence of gallbladder tumours, nor did it affect the occurrence of the hepatic lesions described. Thus, it was not demonstrated that the hepatic lesions are attributable to an enterohepatic circulation of methylcholanthrene. On the other hand, it was observed that portal oval cell proliferation was generally more marked near the gallbladder, diminishing in intensity in more remote portions of the liver. This suggests that the influence stimulating oval cell proliferation may emanate from the gallbladder region. In consideration of the possibility that portal oval cell proliferation may have been caused by bile duct obstruction by enlarging tumour, the livers were examined for evidence of hydro-hepatosis or bile duct dilatation and stasis. Such evidence of biliary obstruction was rarely found; furthermore only an occasional animal had jaundiced body tissues. In addition, when the incidence and severity of oval cell proliferation were compared with tumour size, no correlation

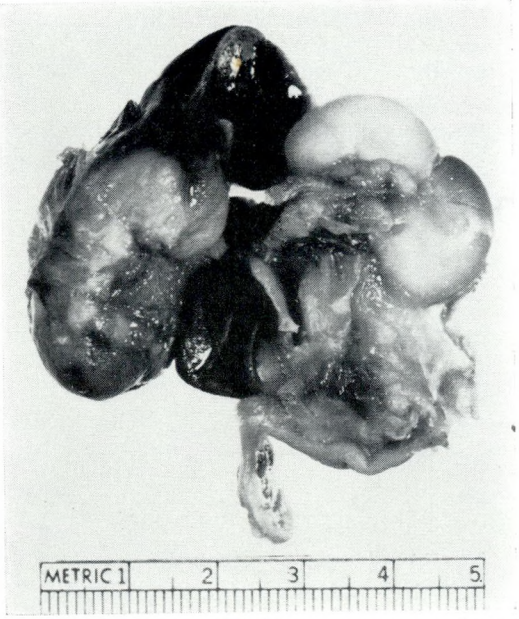

Fig. 19.—Large gallbladder carcinoma replacing part of liver. Nodes at lesser curvature of stomach contain secondary tumour. Gastrohepatic ligament and mesentery invaded: 312 days after pellet implanted (Group A).

TABLE I.—Incidence of Experimental Carcinoma of Hamster Gallbladder

Survival period (days)	*Group*	*Carcinoma*	*Papilloma*	*No tumour*	*Total*
30 - 400	A	14	2	5	21
	B	15	1	5	21
	C	13	0	4	17
Total		42 (71%)	3	14	59
140 - 400	A	13	2	3	18
	B	15	1	3	19
	C	13	0	3	16
Total		41 (77%)	3	9	53

could be demonstrated. Slight oval cell proliferation was found in four animals with no tumours; four hamsters with 1 cm.-4 cm. tumours had no oval cell proliferation; and six animals with 2 cm.-5 cm. tumours had only slight oval cell proliferation. One animal with a tumour only 0.5 cm. in diameter had marked oval cell proliferation.

Discussion

True controls were not possible in this experiment. We are not persuaded that different experimental groups with a variety of intracholecystic foreign bodies as described in some reports represent controls. We are able to state, however, that autopsies on over 250 golden hamsters in this laboratory during the past two years, revealed no instance of spontaneous tumour of the liver or biliary system. Likewise Ashbel[2] found no liver tumours in 1000 autopsies on hamsters.

Ewing[8] found one of the most interesting aspects of gallbladder carcinoma in man to be the high frequency with which it was accompanied by cholelithiasis. The frequency of stones has been variously estimated to be between 70% and 90% of the cases.[1] Zeppa and Womack[18] invoked the hypothesis of carcinogenesis as a two-stage process to explain the part played by stones in gallbladder carcinogenesis. Fortner,[12] pursuing this concept, suggested that the initiating factor was some unknown substance in bile and the promoting factor was the almost invariably present chronic cholecystitis. In the majority of cases the chronic cholecystitis was attributable to stones while in 10% to 30% chronic cholecystitis was of other etiology. Thus, the relationship of stones to carcinogenesis became an indirect one, mediated by chronic cholecystitis. In the present experimental study, inflammatory changes were always present in gallbladders which developed carcinoma and also in those which did not. The inflammatory changes seemed to be attributable to the presence of the methylcholanthrene pellet in the gallbladder lu-

TABLE II.—Invasion and Metastasis of Experimental Carcinoma of Hamster Gallbladder

Survival period (days)	*Group*	*Hamsters with carcinoma*	*Hamsters with direct spread to structures other than liver*	*Hamsters with vascular invasion*	*Hamsters with metastasis*
30 - 400	A	14	8	7	1
	B	15	4	3	4
	C	13	8	11	7
Total		42	20 (48%)	21 (50%)	12 (29%)
140 - 400	A	13	8	6	1
	B	15	4	3	4
	C	13	8	11	7
Total		41	20 (49%)	20 (49%)	12 (29%)
240 - 400	A	10	4	6	1
	B	6	1	2	1
	C	9	4	7	6
Total		25	9 (36%)	15 (60%)	8 (32%)

men. Under the experimental conditions there would seem to be no reason to impute cocarcinogenic activity to cholecystitis since methylcholanthrene is a complete carcinogen possessing both initiating and promoting activity.

Although our data does not permit satisfactory statistical comparison in this regard, examination of the results suggests that surgical manipulation at the time of pellet implantation may have had some influence on the rate of tumour growth and the incidence of metastasis. Those animals in which the cystic duct was ligated developed tumours of larger average size and a higher incidence of metastasis than did those with only pellet implantation. Animals with cystic duct ligation and freeing of the gallbladder from its bed had the largest average tumour size, the highest incidence of vascular invasion and the highest incidence of metastasis.

In our work the occurrence of oval cell proliferation, cystic lesions and bile duct proliferation with fibrosis remains unexplained. Such evidence as can be drawn from the study is of a negative nature, suggesting that mechanical factors are not to be implicated. In this connection Fortner's finding of cystic lesions and cirrhotic changes in the livers of two hamsters dying after 15 to 16 months of repeated subcutaneous injections of bile from human patients with cancer of the common bile duct is of considerable interest.[9] Each of these two animals also had an hepatic carcinoma of bile duct type. In a subsequent publication Fortner[11] interpreted as precancerous some of the intrahepatic bile duct changes in hamsters treated with human bile from cases of extrahepatic biliary tract cancer. The similarity of both the tumour type and the non-neoplastic lesions in Fortner's hamsters to our own material is remarkable and lends some support to the concept that these lesions may be attributable to a chemical carcinogen or some metabolic derivative thereof. Oval cell proliferation, cystic lesions and bile duct proliferation with fibrosis are well known in the field of experimental hepatic carcinogenesis.[17] Opie,[14] studying the pa-

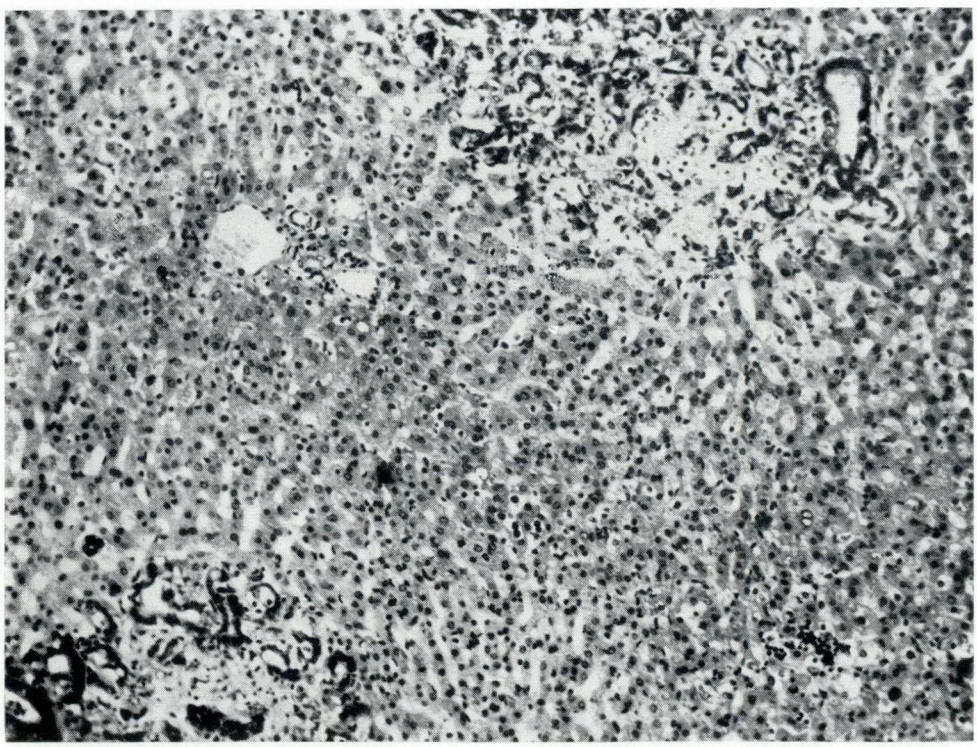

Fig. 20.—Two small foci of metastatic adenocarcinoma in liver from primary adenocarcinoma of gallbladder: 258 days after pellet implanted (Group C; H & E, original magnification x 90).

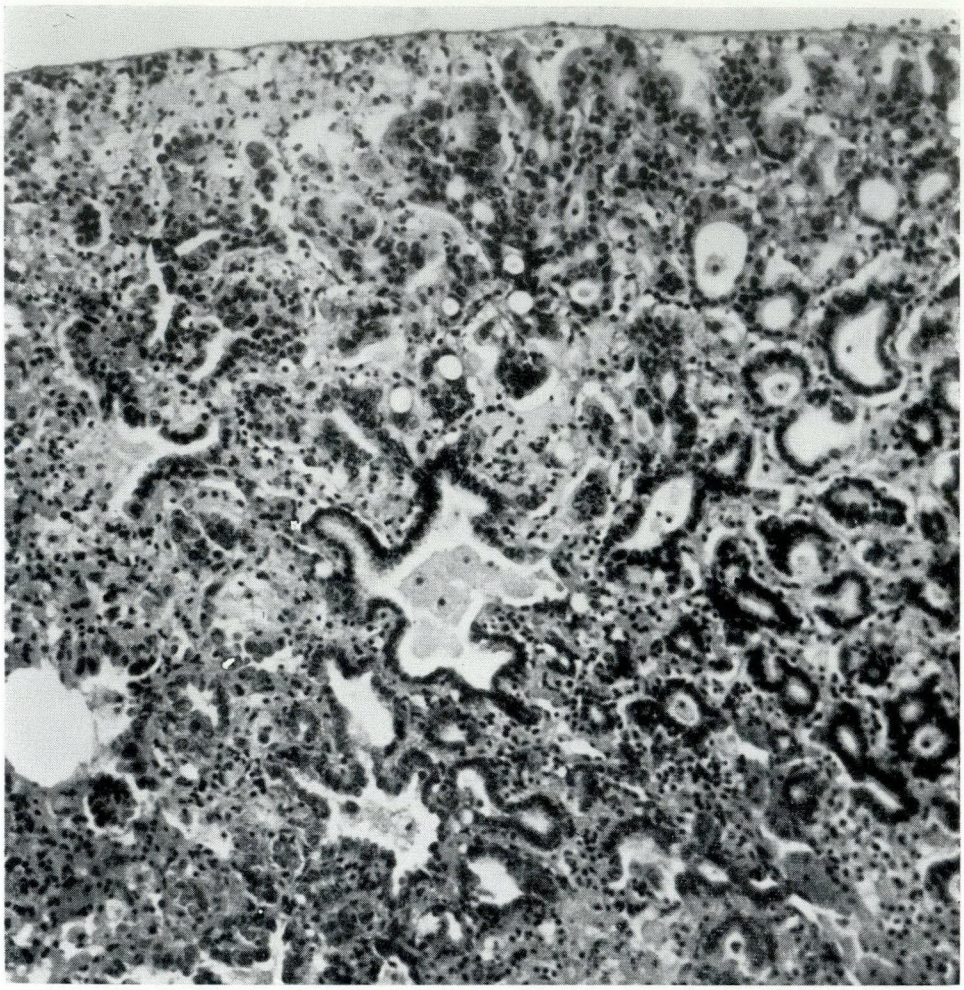

Fig. 21.—Metastatic adenocarcinoma in lung from primary adenocarcinoma of gallbladder. Pleural surface at top of photograph: 346 days after pellet implanted (Group C; H & E, original magnification x 90).

thogenesis of hepatic tumours produced in rats by butter yellow, came to the conclusion that cystic lesions and cholangiofibrosis are preneoplastic lesions. We have not been able to find convincing evidence of the neoplastic transformation of similar lesions observed in our experimental material.

The marked difference in the susceptibility of guinea pig and hamster gallbladders to carcinogenesis under identical conditions remains unexplained. It is startling that the epithelium of the guinea pig gallbladder should remain immune to the carcinogenic influence of methylcholanthrene, one of the most potent carcinogens known, in spite of prolonged and intimate contact.

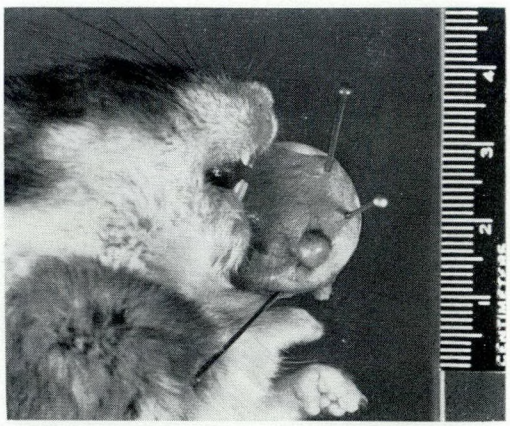

Fig. 22.—Hamster cheek pouch showing first generation tumour transplant from an experimental gallbladder carcinoma.

Even among hamsters, different animals vary greatly in susceptibility to carcinogenesis by methylcholanthrene, for about 25% failed to develop carcinoma in spite of experimental periods of 30 to 351 days and among animals with neoplasm, rates of tumour induction and growth varied widely. Thus, one hamster had a large tumour with distant metastases within 168 days while others had small, only locally invasive tumours as long as 360 days after pellet implantation. Even in the experimental animal exposed to powerful inducing and promoting factors, some individual susceptibility factor plays a major part in carcinogenesis. The fact that the experimental animals were random-bred may be of importance in connection with this variation. However, Berenblum[4] has commented that a wide variation is observed in the latent period of carcinogenesis even among animals (mice) of isogenic strain. In spontaneously occurring gallbladder cancer in man, individual susceptibility undoubtedly also is of great importance and may play a major part in obscuring etiological and pathogenic factors in epidemiological studies of human gallbladder carcinoma. It may be for this reason that clinical and pathological studies of human carcinoma of the gallbladder have yielded so little definitive information on the etiology and pathogenesis of this disease. It may be that the use of an experimental model by which gallbladder carcinoma can be regularly produced by a standard technique will present opportunities for the elucidation of factors which may influence the induction, growth rate and metastasis of carcinoma in this organ.

Summary

Experimental carcinoma of the gallbladder has been produced in over 70% of 59 golden hamsters following the intracholecystic implantation of methylcholanthrene pellets. The malignant neoplastic nature of the tumours has been confirmed by the demonstration of destructive invasion of normal tissues, vascular invasion, lymphatic

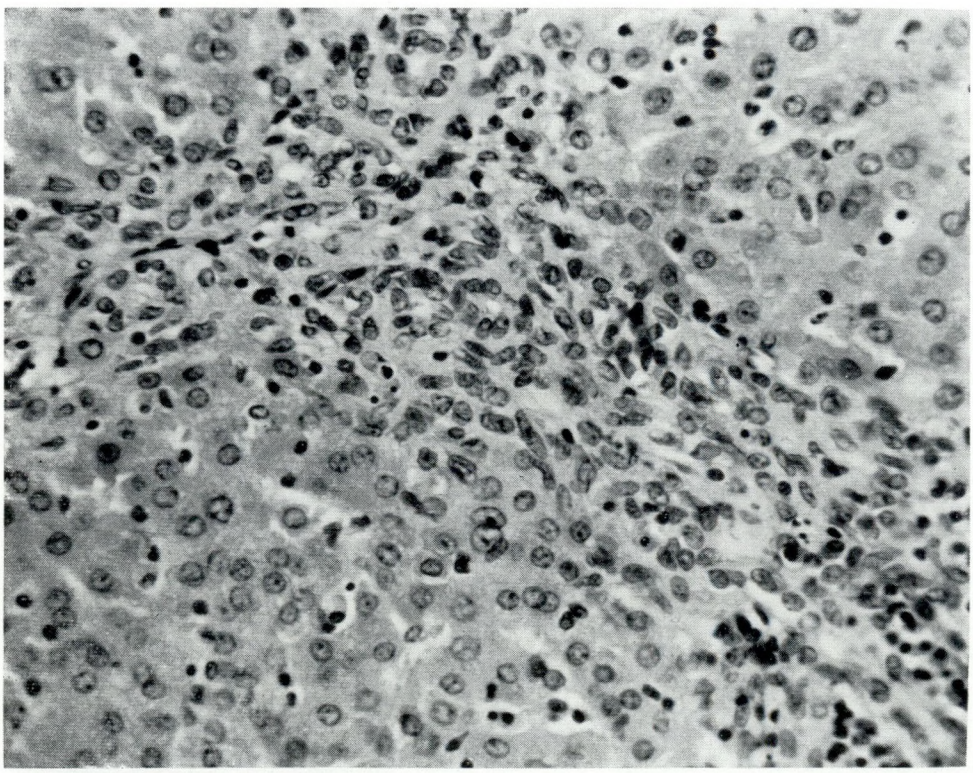

Fig. 23.—Oval cell proliferation in hamster liver: 334 days after pellet implanted (Group C; H & E, original magnification x 225).

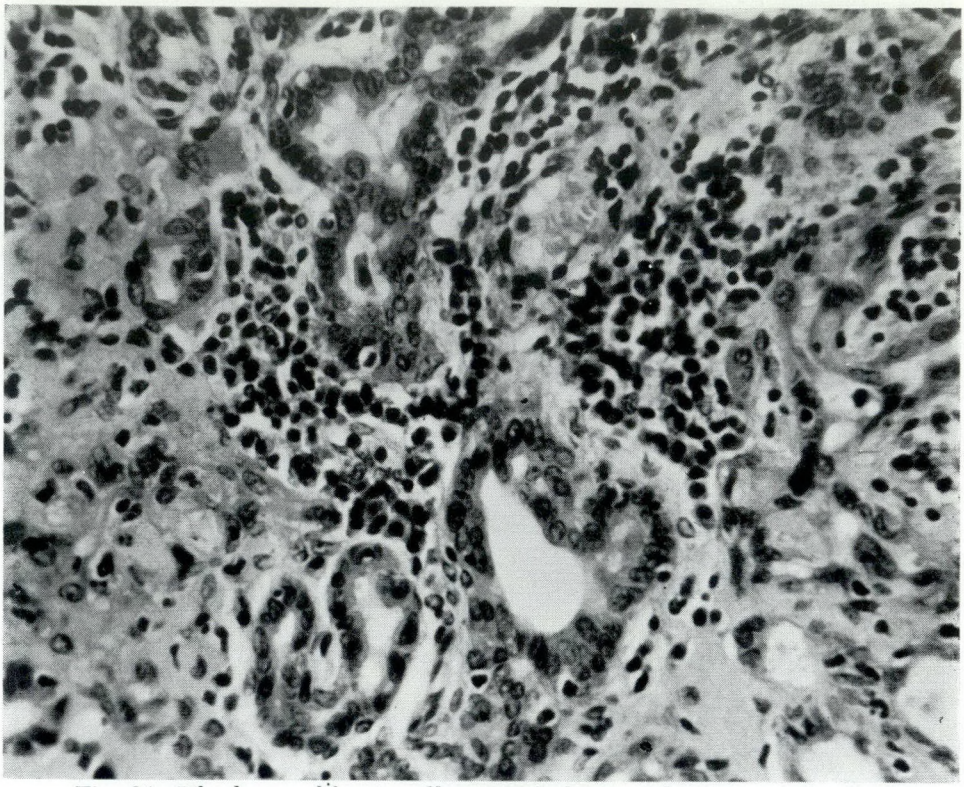

Fig. 24.—Bile duct proliferation, fibrosis and chronic inflammatory cell infiltration in portal region of hamster liver: 214 days after implanted (Group B; H & E, original magnification x 225).

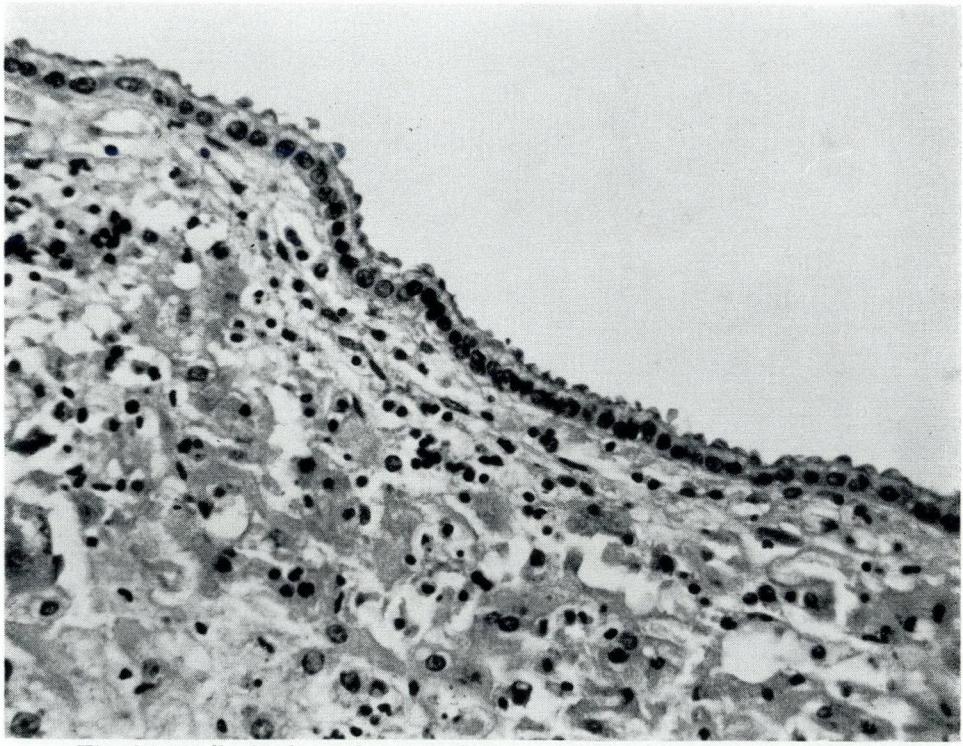

Fig. 25.—Wall of subcapsular cystic lesion in hamster liver: 340 days after pellet implanted (Group C; H & E, original magnification x 225).

and hematogenous metastasis and transplantation to the cheek pouches of normal hamsters.

Several concomitant hepatic alterations have been described including zonal and focal necrosis, portal oval cell proliferation, bile duct proliferation with fibrosis, and cystic lesions. Ligation of the cystic duct at the time of pellet implantation has been observed to have no demonstrable effect on the occurrence of these hepatic lesions.

ACKNOWLEDGMENTS

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Mr. Eric Beamont and Mr. Ted Burton prepared the photographs.

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RÉSUMÉ

On décrit ici une méthode expérimentale permettant d'induire des cancers de la vésicule biliaire chez le "hamster" doré.

Les animaux utilisés étaient âgés de trois mois en moyenne, du sexe mâle. Ils furent divisés en trois groupes: groupe A chez qui on implanta des petites tablettes de methyl-cholanthrène dans la vésicule; groupe B où, en plus de cette implantation, on pratiqua une ligature du canal cystique; groupe C chez qui l'on ajouta aux deux interventions signalées dans le groupe B, une dissection et une séparation de la vésicule de son lit hépatique.

Sur 59 de ces animaux, 54 moururent spontanément, les cinq autres furent sacrifiés. L'autopsie fut pratiquée dans tous les cas: des prélèvements pour histologie furent faits avec fixation en formaline et inclusion à la paraffine.

Dans ces conditions, 70% des cas développèrent un processus tumoral dans les 400 jours qui suivirent l'implantation de methyl-cholanthrène; il ne semble pas y avoir de différence dans les incidences de chacun des trois groupes.

Microscopiquement, la grande majorité de ces tumeurs étaient des adénocarcinomes bien différenciés. Des formations papillaires furent souvent rencontrées, associées à des images kystiques. L'invasion du parenchyme hépatique et des tissus adjacents était un facteur fréquent. Des réactions inflammatoires, consistant en l'envahissement de la paroi vésiculaire par des lymphocytes et des cellules plasmatiques apparurent souvent, sans relation avec la formation de la tumeur.

La malignité des tumeurs ainsi obtenues fut démontrée par les métastases sanguines ou lymphatiques, et par la possibilité de transplanter ces cellules dans la poche jugale de "hamsters" normaux.

URETERO-ILEO-SIGMOIDOSTOMY: SOME OBSERVATIONS ON ITS LIMITATIONS AND DANGERS IN URINARY DIVERSION BASED ON EXPERIMENTAL STUDIES ON MONGREL DOGS*

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RADICAL pelvic surgery is commonly associated with loss or removal of the terminal portions of both ureters and in many cases total extirpation of the bladder. This has intensified the search for a practical and lasting method of urinary diversion to replace these damaged or extirpated structures. Hinman and Weyrauch[1] published an extensive review in 1937 of methods of transplantation of the ureters, dating back in origin as far as 1879. Brunschwig and Greenman[2] in 1959, stated "almost every conceivable method of urinary diversion has been tried experimentally and/or clinically in the past". Thompson[3] has aptly considered the implications of the search for an adequate method of urinary diversion in three phases – surgical, renal and electrolyte. It is the latter two phases that are now being investigated extensively.

The work of Swenson, Fisher and Cendron,[4] and Swenson and Fisher[5] on total replacement of aganglionic ureters in children by a loop of ileum, led us to the investigation of this problem described in this report. Would total replacement of the ureter be a safer procedure than partial replacement? The pelvis and the ileum would be of much more equal size. Stricture would be less common. The absorptive area of the ileum would increase the chance of electrolyte imbalance. We have proved experimentally that a loop of ileum, six inches to 12 inches long can be used quite safely to replace the ureter[6] and have demonstrated both experimentally (Figs. 1 and 2) and clinically, that a solitary kidney, with an ileal ureter, if not obstructed or infected, will sustain life in an individual or animal. A patient with a solitary hydronephrotic kidney of severe degree has survived three years with an ileal ureter attached to her lower dilated calyx (Fig. 3). Infection and electrolyte imbalance has been no problem.[6, 7]

Stimulated by these results, it was considered worthwhile to study similar procedures with a Bricker Pouch[8-11] attached to the sigmoid. Would a loop of ileum placed between the ureter and the sigmoid protect the kidney against ascending infection? Would electrolyte balance be maintained in cases in which no obstruction existed?

Originally, it was intended to transplant both ureters into a loop of ileum eight inches to 10 inches long, the proximal end being closed and the distal end attached by an end-to-side anastomosis to the lower sigmoid. At this time Turnbull and Higgins[12] reported a similar technique with the addition of a valve at the distal end of the ileum which was inserted into the sigmoid as depicted in their original drawing (Fig. 4). Using the technique of Turnbull and Higgins, five separate experiments were carried out to test the value of this procedure, the type of experiment changing as the investigation proceeded.

Anesthetic and intravenous therapy.—Intravenous Combutal® or Nembutal® were used in all of these experiments. During the operation a slow drip of 5% dextrose in water was administered.

Preoperative preparation.—Fluids only were administered for 48 hours before operation. A laxative was given the night before operation and a cleansing enema was given several hours preoperatively. In the first series of animals, no drugs were administered to sterilize the intestinal tract. In the last four experiments, one or two tablets of Polyneosal* were administered

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*Polyneosal (Neomycin sulphate 70,000 mcg., Polymixin B sulphate 10,000 units; sulfamerazine 100 mg., sulfathiazole 100 mg., sulfanilamide 100 mg.).

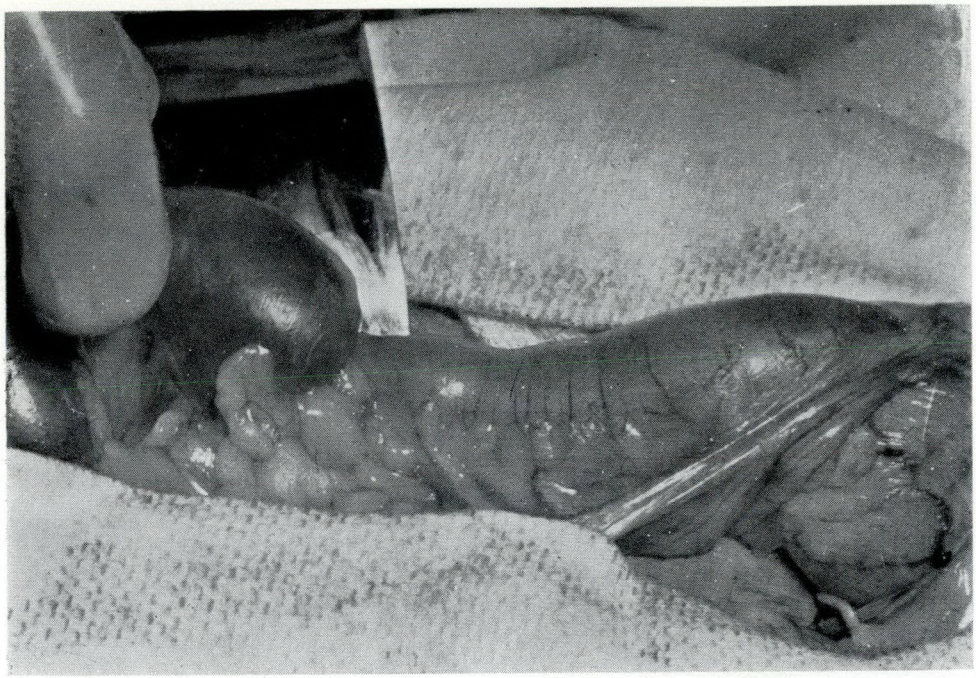

Fig. 1.—The ureter has been completely replaced with a loop of ileum. The ileal ureter and bladder are distended with water to show the outline better.

every eight hours, according to the weight of the dog, for three days preoperatively and continued for at least 10 days postoperatively.

Bacteriological and biochemical studies.—In the last three experiments cultures were taken from the ileal bladder and sigmoid each time the bowel was opened. Electrolyte studies were carried out in the last four series.

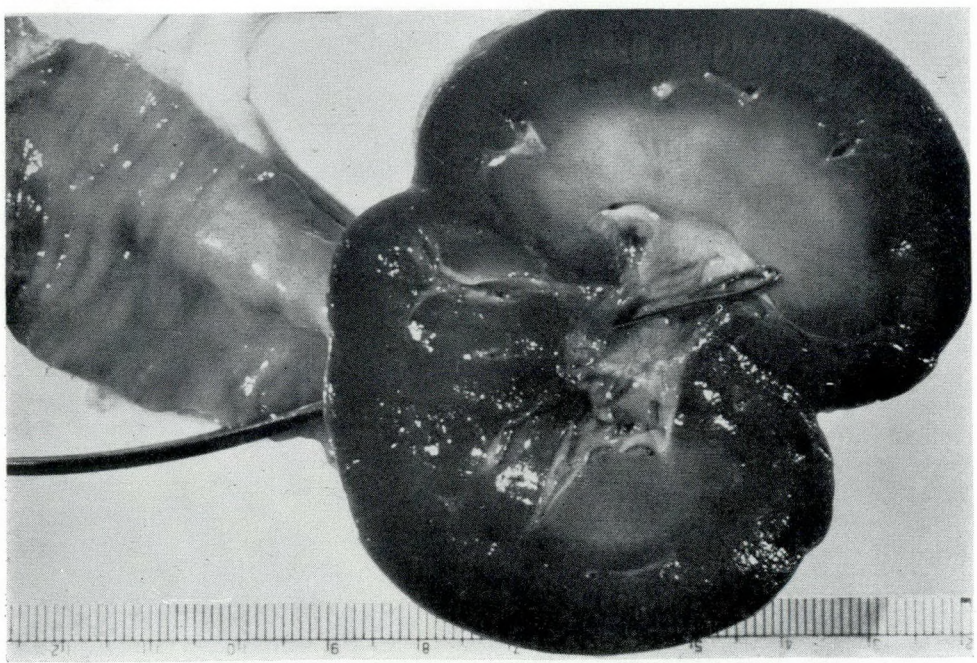

Fig. 2.—The kidney has been bisected. The ileum is opened and a probe has been passed into the pelvis of the kidney.

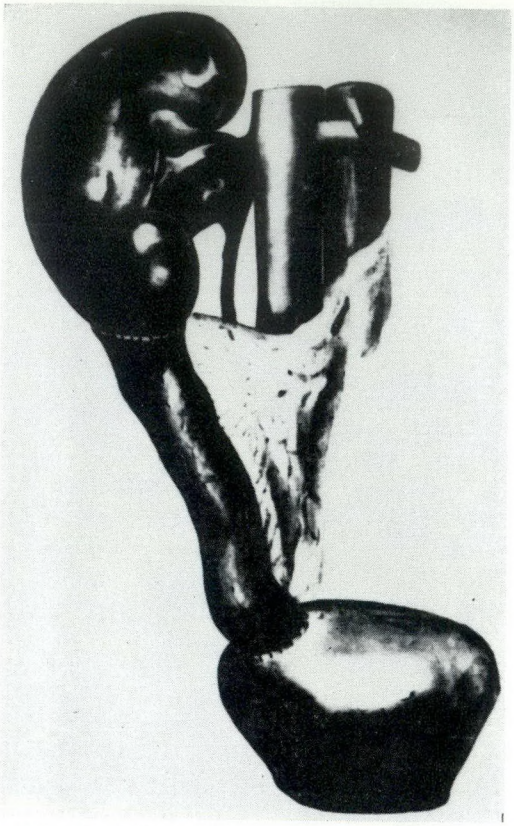

Fig. 3.—A loop of ileum has been anastomosed to the lower calyx of the kidney proximally. Its distal end is attached to the bladder end-to-side. The ileal loop was passed through the mesentery of the ascending colon and anastomosed in an extraperitoneal position.

EXPERIMENT 1

Eight mongrel dogs ranging from 14 lb. to 30 lb. were used. An ileal loop eight inches to 12 inches long was isolated. The continuity of the ileum was established by end-to-end anastomosis. The proximal end of the ileal loop was closed. A valve was formed on the distal end of the isolated loop and this was inserted into the sigmoid just above the peritoneal reflection with 0000 chromic catgut and silk. The ureters were then divided and transplanted into the isolated ileal loop (Fig. 4). The abdomen was closed with chromic 0 catgut and the skin was closed with dermal sutures.

Three animals died before recovering from the anesthetic. These were considered anesthetic deaths. The remaining five died within four days. At postmortem examination no obvious cause for death was evident. Histological examination of the kidneys showed only a membranous glomerulitis, tubular degeneration and protein exudate into glomeruli and proximal tubules (Figs. 5 and 6).

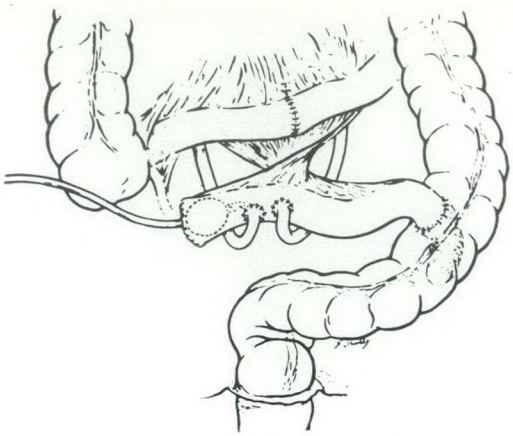

Fig. 4.—A diagrammatic sketch of Turnbull and Higgins' procedure (reproduced by permission of the authors and the publishers of the Cleveland Clinic Quarterly).

It was decided to change the approach to the problem by dividing the operation into stages. In addition, preoperative preparation of the bowel with Polyneosal was instituted. Following operation an antibiotic was administered intramuscularly daily until the animal tolerated oral therapy. The electrolytes were checked preoperatively and at staged intervals until the experiment ended.

EXPERIMENT 2

In a previous publication it was reported that an animal with one ureter completely replaced by an ileal loop anastomosed to the bladder, survived and showed no electrolyte imbalance after the opposite, normal kidney was removed.[6]

In the second experiment the following procedure was carried out in stages on two dogs. The ileal loop was isolated and inserted into the sigmoid as in the first experiment. At the end of one month or more, it was found that there was no evidence of edema in the ileal loop or valve. The loop was completely empty indicating good drainage. The right ureter was transplanted into the ileal loop. At the end of one month the electrolytes were found to

be normal. An intravenous pyelogram revealed a normal kidney on both sides. A barium enema revealed that there was no reflux into the ileal loop. The left kidney was then removed in both dogs.

In the first dog, No. 10, the blood urea nitrogen rose to 244 mg. % in seven days and to 270 mg. % on the 10th day. Muscular twitching, nausea, vomiting and loss of weight were marked. The animal died on the 10th day in obvious uremia. The second animal, dog No. 11, followed an identical course, the B.U.N. rising to 236 mg. % on the ninth day. This animal died on the 10th day.

An immediate postmortem examination was carried out on both animals. There was no infection in the peritoneal cavity. The ileal loop was intact and not distended. The kidney, ileal bladder and a portion of the sigmoid were removed and photographed. The postmortem findings in dog No. 11 are shown in Figs. 7 and 8. Fig. 9 is a photograph of an ileal valve protruding into the sigmoid. The pathological report on dog No. 11 was as follows: "The specimen consists of a kidney with attached ureter which is anastomosed to an ileal bladder. The distal portion of the ileal bladder is anastomosed to a segment of the sigmoid. The kidney is depleted of its capsule and measures 7.0 x 7.0 x 3.0 cm. The cortical surface is smooth and deep reddish brown throughout. On cut section, the cortex averages 6.0 mm. and the pyramids 1.5 mm. Both are moderately hyperemic but well demarcated. The renal pelvis is not distended and averages 3.0 mm. in diameter. The length of ureter present measures 13.0 cm. The uretero-ileal anastomosis is intact and patent from within the ileum. There is a small mucosal-like protrusion at the site of the anastomosis which is bluish-red in colour. The ureteral mucosa is smooth and glistening. The segment of ileum measures 12.0 cm. in length by 3.5 cm. in circumference throughout. There is slight loss of rugal folds throughout the ileum but no ulcerations are observed. The wall measures 0.4 cm. in thickness. The ileosigmoid anastomosis is patent. The mucosal junctions protrude within the

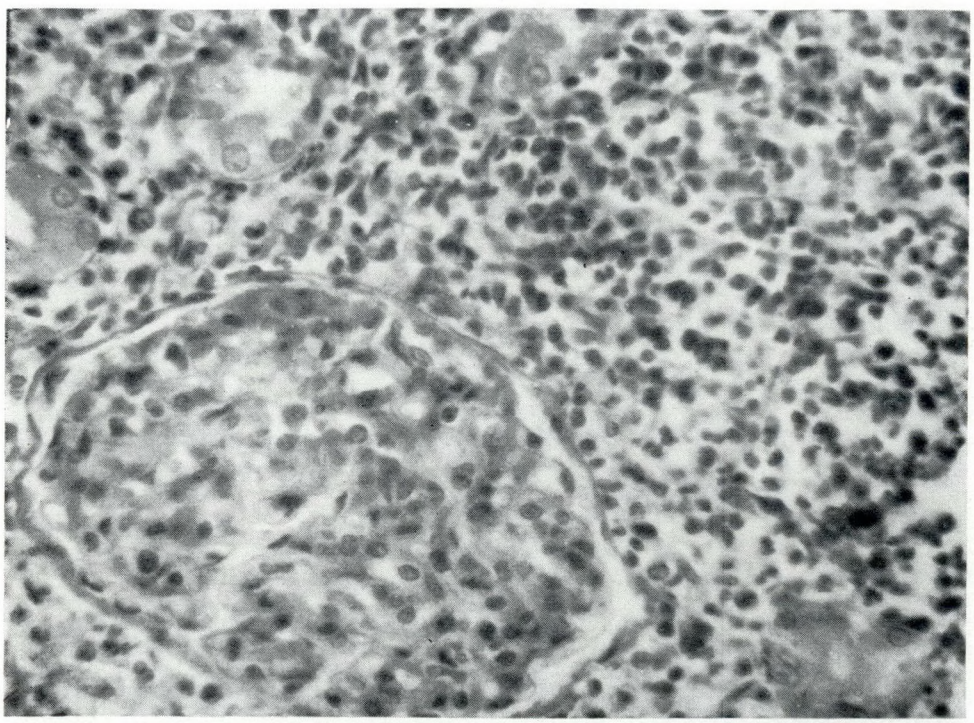

Fig. 5.—Membranous glomerulitis. The capillaries have thickened walls. The surrounding stroma contains chronic inflammatory infiltrate (original magnification X 400).

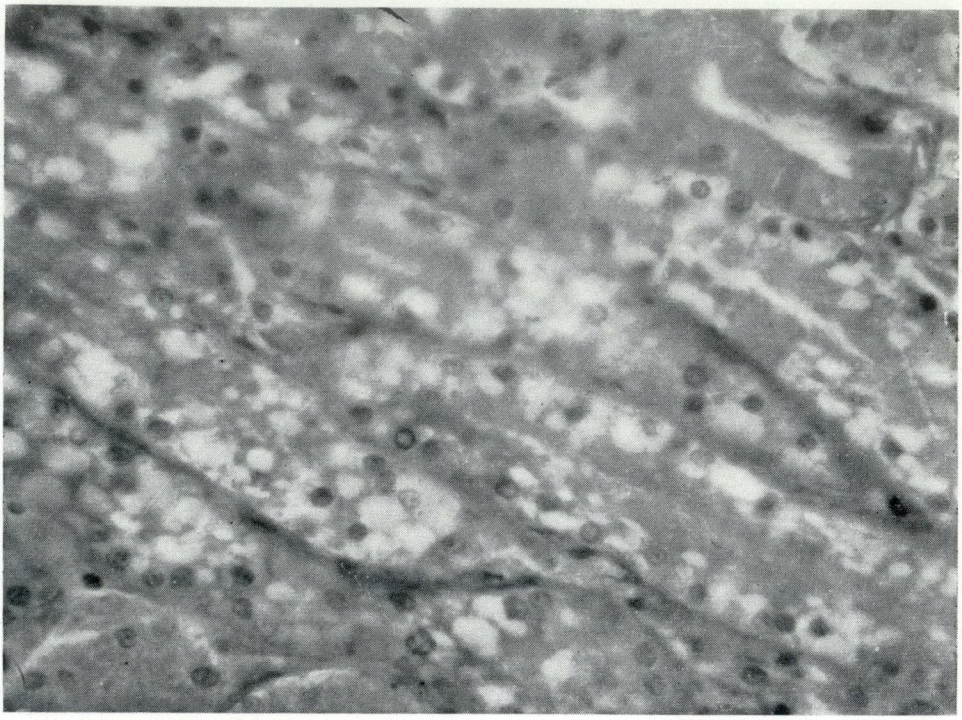

Fig. 6.—Renal tubular changes. There is vacuolation of the tubular epithelium and protein material within the tubular lumina (original magnification X 400).

sigmoid as a small nodule measuring 8.0 mm. in height. The sigmoid mucosa is slightly increased in redness but otherwise not remarkable along the margins of the anastomosis. The segment of sigmoid is 12.0 cm. in length by 5.0 cm. in circumference. There is slight flattening of the transverse mucosal folds but no ulcerations are noted. Attached to the ileum is a small amount of mesentery which contains engorged vessels."

Microscopically, the kidney sections showed protein transudate in Bowman's space and in the proximal convoluted tubules and there was mucosal atrophy of the ureter. The ileum and colon showed no microscopic abnormality.*

Bacteriology.—Cultures were taken under sterile precautions from the ileal bladder and kidney pelvis and a pure culture of *E. coli* was grown from both organs. It was sensitive only to Furadantin.®

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*The autopsy report was prepared by Dr. M. Hamonic.

EXPERIMENT 3

In this series, preoperative and postoperative care, electrolyte and bacteriological studies were carried out as in Experiment 2.

In two animals an ileal loop was isolated. The continuity of the intestinal tract was re-established and the proximal end of the isolated loop was closed. A valve was formed at the distal end and inserted into the sigmoid. After a month or more the right ureter was transplanted into the ileal loop. The second ureter was transplanted in like manner after a similar period of time.

The first animal in this experiment (dog No. 12) lived seven days following transplantation of the second ureter. The B.U.N. rose from 20 mg. % to 169 mg. % before death. The electrolytes were otherwise normal.

The second dog (No. 14) lived for 28 days. The B.U.N. rose from 20 mg. % at the time of the second transplantation to 330 mg. % the day before death. Serum

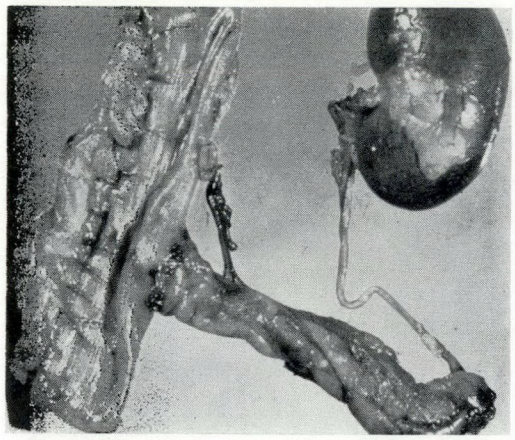

Fig. 7.—Postmortem specimen of an ureteroileo-sigmoidostomy from an experimental dog (No. 11). Note the normal appearance of the ureter and kidney.

sodium rose from 119 mEq./l to 139 mEq./l. and the serum chlorides fell to 83 mEq./l. The CO_2 combining power fell to 6 mEq./l.

Postmortem examinations were performed on these animals directly after death.

Pathological report (dog No. 12).—"The specimen consists of colon with laterally anastomosed ileal loop. Both right and left ureters are included and are anastomosed laterally to the ileal loop and the attached kidneys are also present. The left kidney is small (approximately one-half the size of the right) and measures 3.0 cm. in length by 1.0 cm. in width by 1.2 cm. in thickness. Its capsule is thin and strips readily. The cortical surface is small, deep reddish-grey and on section the cortex averages 0.6 cm. in thickness. It is well demarcated from the adjacent medulla which is pale grey. The pelvis is not dilated. The ureter is patent except at a point 3.0 cm. from its site of anastomosis, where it is thickened and narrowed to less than 0.1 cm. The distal portion beyond the narrowing is collapsed and the anastomotic site cannot be identified. The right kidney measures 5.0 x 3.0 x 2.0 cm. and does not appear remarkable. The right ureter is patent and the anastomotic opening is not remarkable. The ileal loop contains mucoid-like material and the mucosa is somewhat flattened. The ileal-sigmoid anastomosis is patent. The sigmoid segment is not remarkable."

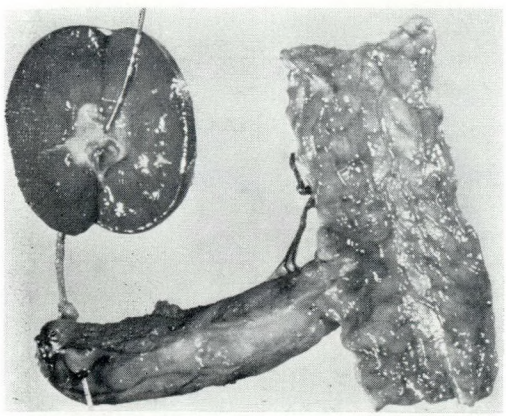

Fig. 8.—The kidney has been bisected and appears grossly normal. The ileal bladder and sigmoid have been laid open. A probe has been passed from the kidney pelvis, down the ureter into the ileal bladder.

Protein tubular casts were noted in sections of the right kidney. The ileum and colon showed no microscopic abnormality. The pathologist's diagnosis was "Chronic peri-ureteritis with luminal obstruction, left."

Photographs were taken of the specimens in this case and are shown in Fig. 10.

Pathological report (dog No. 14).—"Sub-

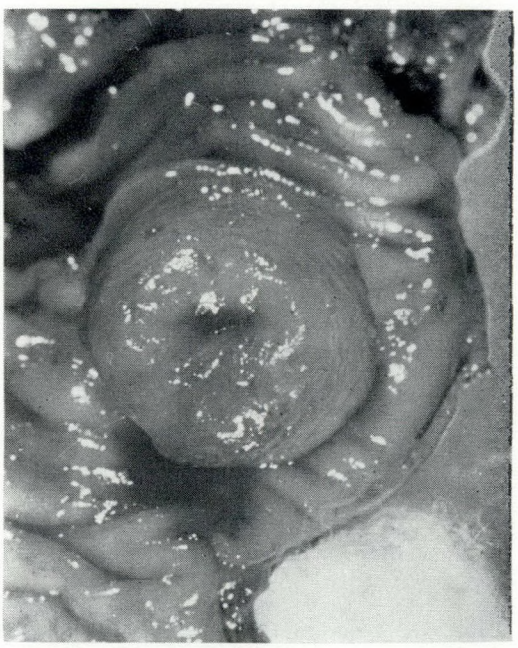

Fig. 9.—Actual photograph of an ileal valve extending into the sigmoid, using the technique of Turnbull and Higgins.

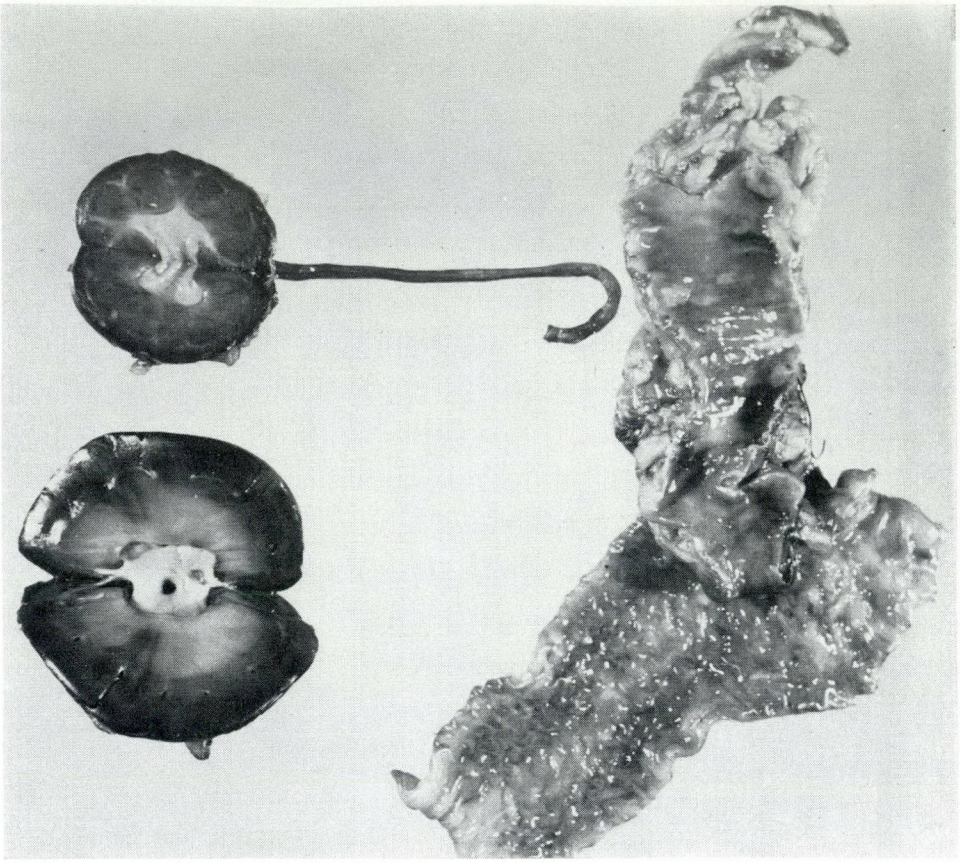

Fig. 10.—The stricture at the lower end of the ureter was considered to be a surgical error at the time of transplantation.

mitted are two kidneys with attached ureters anastomosed to an ileal loop bladder. The latter is anastomosed to the sigmoid colon by an end-to-side anastomosis. The right kidney shows no evidence of hydronephrosis but scattered throughout are zones of hemorrhage and regular small foci which are pale and probably correspond to abscesses. The ureter is patent. The ileal loop and sigmoid are not remarkable. The left kidney shows moderate hydronephrosis and pus within its pelvis.

Diagnosis.—Acute bilateral necrotizing papillitis, pyelonephritis and ureteritis (Figs. 11, 12 and 13). Unilateral moderate hydronephrosis due to external obstruction of the ureter by a fibrous band.

Bacteriology.—Culture from the ileal bladder at the time the second ureter was transplanted showed a few saprophytic staphylococci and *E.coli.* At the time of death only *B.proteus* was cultured.

EXPERIMENT 4

Eight animals were prepared as previously described. An ileal bladder with a Turnbull valve was formed at the first stage and inserted into the sigmoid colon. Bilateral ureteral transplantation of both ureters was performed after one month or more. It has been previously shown that all edema disappears from the loop and valve during this period and that there is good drainage established from the loop into the sigmoid. The possibility of the ureters draining into a closed loop has been avoided.

Electrolyte studies were conducted preoperatively and at staged intervals until the animals succumbed. Cultures from the ileal bladder were taken at the time of ureteral transplantation and also from the kidneys and ileal loop at the time of death.

In seven animals the postoperative course was similar. The B.U.N. rose gradually but

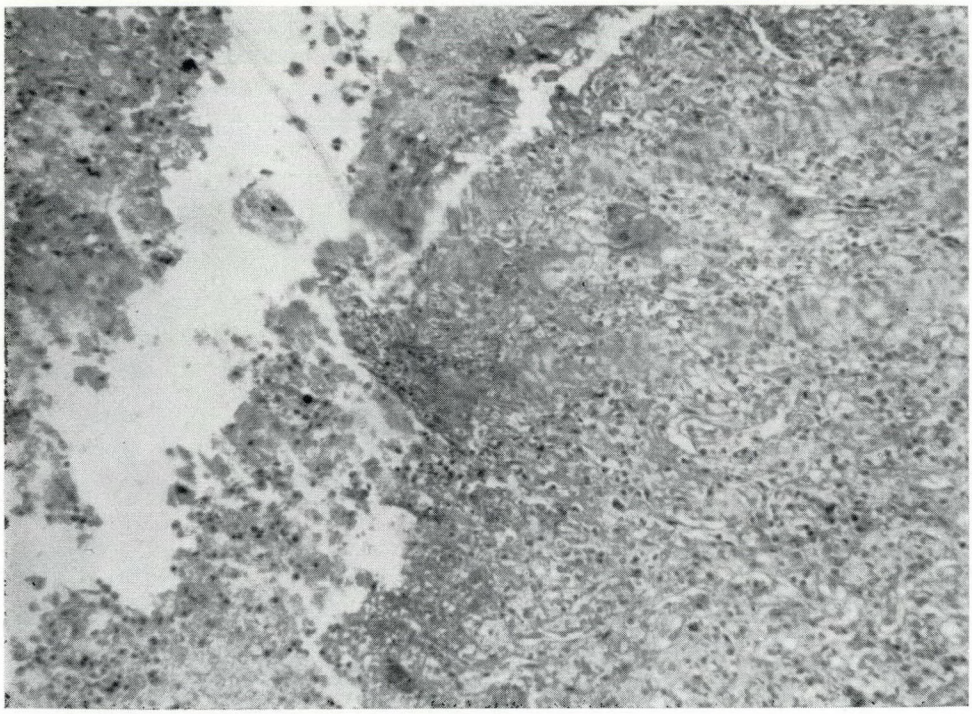

Fig. 11.—Necrotizing papillitis. Note ulceration of the renal papillae and the acute inflammatory reaction present (original magnification X 150).

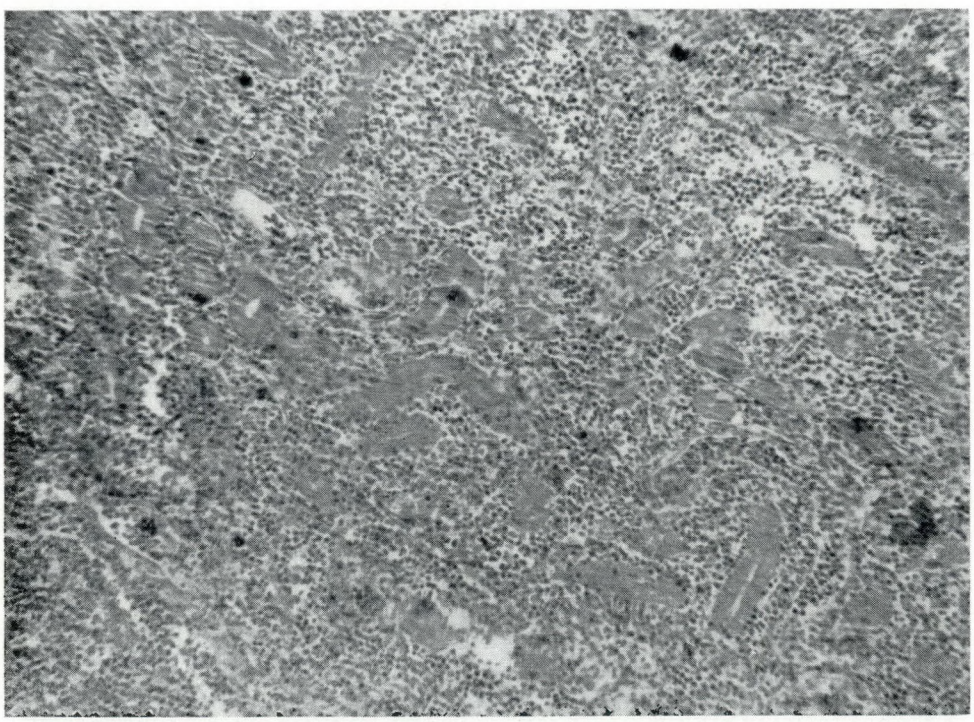

Fig. 12.—Acute pyelonephritis. The interstitial tissues are diffusely infiltrated by acute inflammatory cells (original magnification X 150).

TABLE I.—Progressive Electrolyte Changes Following Total Replacement of Bladder by Ileal Loop (Uretero-Ileo-Sigmoidostomy): Bilateral Transplantation of Ureters (Second Stage)

Number	*Blood urea nitrogen mg.%*		*K mEq./l.*	*Na mEq./l.*	*Cl mEq./l.*	*Survival (days)*	*CO_2 mEq./l.*
13	4		3.9	135	110		20
	16		4.8	143	102		18
	93		3.9	136	102		13
	70		3.5	138	110	26	
	D						
15	17		5.1	148	102		23
	14	60	4.5	144	107		14
	22	46	3.9	139	113		13
	25	—	2.9	178	110	31	
		D					
16	20		4.6	143	105		22
	22		4.8	144	106		24
	74		4.6	140	110		18
	102		4.8	138	112	30	16
	D						
20	11		4.5	145	106		24
	20		4.7	142	99		28
	20		3.5	139	104		14
	50	42	4.3	158	136	2½	10
	52	—		148		months †	
		D					
23	16		5.0	144	103		28
	16		4.8	147	113		25
	84		4.9	140	115	10	25
	D						
25	14	156	4.4	146	105		23
	10	84	4.2	146	110		20
	134	—	3.8	137	105	22	14
		D					
26	17		3.0	140	108		19
	10	170	3.6	142	110		20
	84	146	3.6	146	120		15
	142	—	3.2			26	16
		D					
32	16		4.0	134	112		20
	20		4.3	140	102		18
	68		3.8	135	100		15
	82		3.2	129	105	16	11
	D						

The first figure in each column represents the electrolyte estimation preoperatively.

The second figure in each column represents the electrolyte estimation at the time of ureteral transplantation.

The succeeding figures represent periodic electrolyte studies during the interval before death.

Key—Survival—Duration of survival following ureteral transplant.

†—Dog No. 20 lived two and one-half months and died suddenly.

D—Died.

not so fast or as high as in the animals in which ureteral transplantation was performed at staged intervals (Table I). Serum chloride and sodium levels remained within normal limits. The potassium fell to a low normal and the CO_2 combining power fell in all cases, the average being 13.8 mEq./l. The average duration of life in the seven animals following ureteral transplantation was 23 days.

The eighth dog (No. 20) followed a different course. There was an interval of seven weeks between the formation of the ileal bladder and the ureteral transplantation. The B.U.N. at the first stage was 11 mg. % and at the second stage 20 mg. %. This was checked for the next six weeks at weekly intervals and was as follows: 26, 50, 52, 42, 36 and 32 mg. %. The CO_2 combining power fell as the B.U.N. rose and rose as the B.U.N. fell. The animal was gaining weight, looked better and ate better. Electrolyte studies were then temporarily discontinued. The animal died suddenly two and one-half months following ureteral transplantation.

Postmortem findings.—The right kidney was a huge thin-walled hydronephrotic sac. The ureter was dilated. The left kidney appeared grossly normal. The entire system was removed for photographing and pathological study. Cultures were taken. Figs. 14 and 15 illustrate the pathological findings.

Pathological report (dog No. 20).—"*Gross.* The specimen consists of a right kidney which is markedly hydronephrotic and composed essentially of a thin, flattened cortex 4.0 mm. in thickness. The kidney measures 4.5 x 3.0 x 2.0 cm. The pelvis is 3.0 cm. in length and 2.0 cm. in width. There is distention of the right ureter which appears to be totally occluded at its site of anastomosis with the ileum. However, under forceful pressure on the ureter, water can be passed through the latter opening. The left kidney measures 5.0 x 3.0 x 2.0 cm. and is not hydronephrotic. However, the left ureter is slightly distended and its os is slightly narrowed as well. The narrowing at the uretero-ileal anastomosis is due to thickening of the walls of the ureter. Also submitted is a segment of ileum. A separate segment of colon is also present".

Microscopically the right kidney showed marked hydronephrosis accompanied by

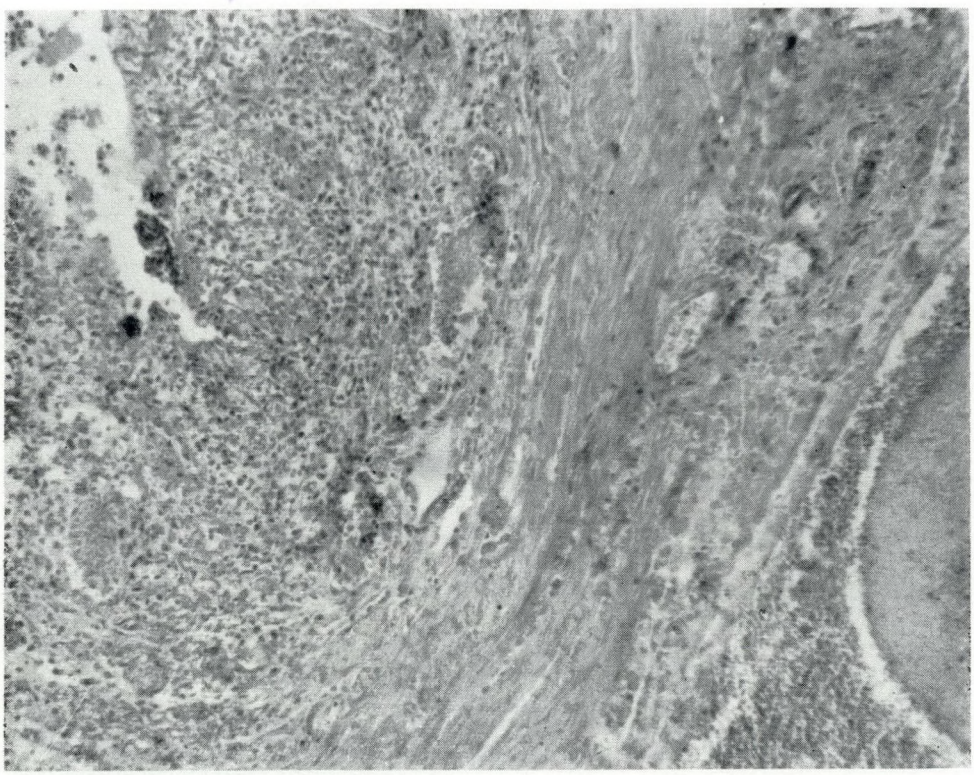

Fig. 13.—Acute ureteritis. The mucosa is ulcerated and an acute and chronic infiltrate is seen throughout the wall associated with edema and early fibrosis (original magnification X 150).

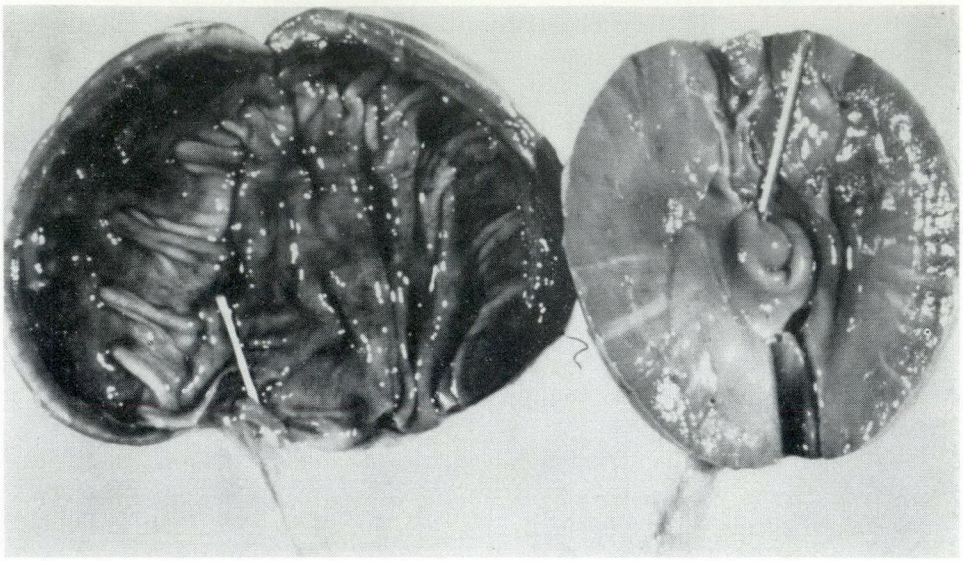

Fig. 14.—The right kidney is a huge hydronephrotic sac due to a stricture in the lower end of the ureter.

hydroureter, acute pyelitis and ureteritis. There was superficial atrophy of the ileal mucosa. The left kidney showed slight hydroureter, chronic pyelitis and ureteritis.

EXPERIMENT 5

On November 17, 1959, an ileal loop was formed and attached to the sigmoid in dog No. 21 which weighed 22 lb. Bilateral

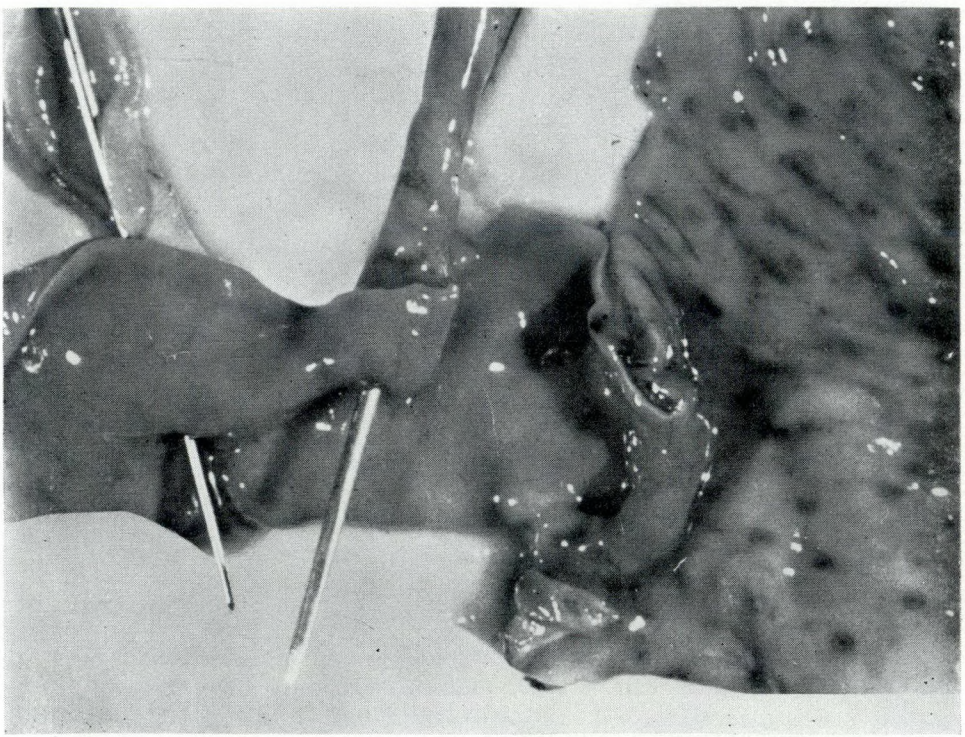

Fig. 15.—The ureter on the right is grossly dilated. There is a firm hard stricture just proximal to its insertion into the ileal bladder. It was not complete as a fine probe passed through it.

ureteral transplantation of both ureters was done on December 22. On December 28, the B.U.N. was 50 mg. %. Repeat serum electrolyte studies on January 18 gave the following results: B.U.N. 76 mg. %, potassium 3.0 mEq./l., sodium 145 mEq./l., chlorides 120 mEq./l., CO_2 combining power 13 mEq./l. The animal's weight had fallen to 18 lb. and it was in poor condition. On January 19 the ileal loop was disconnected from the sigmoid, and an end-to-side anastomosis of the ileal loop to the bladder was performed. On March 30, the animal had regained its normal weight, the B.U.N. had fallen to 28 mg. % and the dog looked well. On June 25, the B.U.N. was 22 mg. % and the animal weighed 23 lb.

Discussion

The rapid occurrence of death after operation in the first series of dogs is noteworthy. In the Bricker procedure open drainage of the loop is established at the original operation. In Turnbull and Higgins' operation, the loop is decompressed by inserting a Foley catheter into the proximal end of the isolated ileal loop. This is not possible in animal experiments unless the animal has been trained to survive in a sling. The institution of a two-stage operation appeared to have the same effect at least to a considerable degree. We felt that in the first series of dogs, edema and constriction at the insertion into the sigmoid, together with the constrictive effect of a valve at the distal end of the ileum, converted the ileal bladder into a closed loop. The deaths were undoubtedly due to biochemical disturbances rather than to infection.

Barium enemas were done in four dogs to test the efficacy of the ileal valve in preventing reflux into the ileal bladder. There was no reflux in any of the four animals and thereafter the procedure was discontinued.

In four dogs not included in this series, the ileal loop came out of the sigmoid and general peritonitis followed. This was considered to be a technical error.

In three dogs the ileal bladder underwent intussusception into the sigmoid and protruded from the rectum. Two of these animals were sacrificed. Dog No. 20, one of the animals with this complication, was subjected to re-operation. The ileal bladder and part of the sigmoid were resected and the sigmoid was then re-anastomosed by an end-to-end anastomosis. The abdomen was closed. The animal did very well and was used six weeks later for the same experiment. As a result of this complication the ileum was thereafter stitched to the side of the sigmoid for one inch proximal to its insertion. This appeared to prevent further instances of intussusception of the ileal bladder into the sigmoid.

In one dog a huge pyosalpinx associated with mild peritonitis was found. This animal was omitted from the series.

In the last four series of experiments, all animals developed an ascending infection, including the animal that survived after disconnecting the ileal bladder from the sigmoid and reimplanting it into the bladder proper. These infections varied from a chronic pyelitis to an acute ascending ureteritis, pyelitis and pyelonephritis. It would therefore appear that the valve does not prevent the proximal extension of infection from the sigmoid.

Summary

This is a preliminary report. It is realized that the number of experimented subjects in this series is not sufficiently large to justify definite conclusions but it is considered that the following pertinent observations are in order.

Obstruction, infection, and reabsorption are the principal causes of renal failure after creation of an ileal bladder.

Either a two-stage procedure or decompression of the ileal loop will prevent obstruction from edema at the site of insertion into the sigmoid. Careful anastomosis may prevent ureteric strictures such as those that caused failure in the most promising case (dog No. 20) in the study reported here.

In dogs, the peristaltic action of the ileum does not prevent ascending infection (but this problem mainly causes serious trouble where there is stricture formation and is not inescapable).

In the absence of mechanical or infectious complications, uremia seems to be due to reabsorption of urea and hydrogen, the absorptive surface after uretero-ileo-sigmoid anastomosis being much greater than that created by uretero-ileal diversion of urine.

The changes due to reabsorption are reversible. Disconnecting the ileal loop from the sigmoid and reimplanting it into the bladder restores the animal to health and electrolyte balance. One animal was able to restore efficient excretion of urea and acid with the ileal bladder still anastomosed to the sigmoid.

Mucus plugs have caused no trouble in these experiments with ileal loops.

ACKNOWLEDGMENT

This research problem was carried out on Grant No. S257 from the Banting Research Foundation.

The bacteriological, pathological, radiological, photographic, biochemical work and anesthetics were generously provided by the various departments of St. Boniface Hospital.

The firm of Johnson & Johnson supplied a great proportion of the suture material. Diagram (Fig. 3) was drawn by Miss Joy, medical artist.

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RÉSUMÉ

La chirurgie radicale du pelvis se voit souvent entraînée dans des résections partielles des bouts terminaux des uretères des deux côtés et aussi de la vessie. Ceci a naturellement conduit à intensifier les recherches en vue de trouver un moyen pratique de détournement des urines. Différents moyens on été proposés pour ce but. Les auteurs ont procédé à des séries d'expériences sur des chiens à la même fin.

Dans une *première série*, on isola une anse d'iléon de huit à 12 pouces de long; la continuité de l'intestin fut rétablie par une suture termino-terminale; le bout proximal de l'anse iléale fut fermé; sur l'extrémité distale on forma une valvule et l'on inséra le tout dans le sigmoïde juste au-dessus de la ligne de réflexion du péritoine. Les uretères furent alors sectionnés et transplantés dans cette boucle. Tous les animaux d'expérience moururent dans les quatre jours subséquents. Il fut alors décidé de procéder à ces essais par paliers.

Deuxième série.—On procéda dans un premier temps à l'isolation et à l'insertion de l'anse iléale. Un mois plus tard, on fit l'implantation urétérale à droite. Un autre mois plus tard le pyélogramme intra-veineux et le lavement baryté étaient normaux. On enleva le rein gauche. Les chiens moururent rapidement d'urémie.

Troisième série.—On procéda comme dans la série 2 pour le premier temps. Un mois plus tard on inséra l'uretère droit dans l'anse iléale et un autre mois plus tard on fit de même pour l'uretère gauche. Les chiens moururent de pyélonéphrite et d'uréterite bilatérales.

Quatrième série.—On procéda ici comme précédemment, mais les implantations urétérales furent faites simultanément et plus tardivement. Ici, les suites furent variables selon les animaux.

Cinquième série.—Les premiers temps furent ici conduits comme dans les séries précédentes. L'évolution post-opératoire ressembla en tous points à ce qui a été précédemment décrit. Cependant, après trois mois, l'animal ayant un état général médiocre, on décida de supprimer l'anastomose iléo-sigmoïdienne et de réimplanter l'anse iléale dans la vessie. L'état de l'animal s'améliora rapidement.

Il ressort de l'ensemble de cette expérimentation que, en dehors de toute complication infectieuse et de toute obstruction mécanique, l'urémie apparaît; elle est causée par la réabsorbtion d'urée au niveau de la muqueuse iléale. Ceci semble être bien démontré par la cinquième série expérimentale: les phénomènes apparaissent comme réversibles. En effet, après installation d'un état urémique, celui-ci peut être supprimé par la réimplantation de l'anse iléale dans la vessie.

SURGICAL TECHNIQUE

INCISIONS, LACERATIONS AND SCARS

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THE AVOIDANCE of poor scars is both functionally and cosmetically important to any patient. These can be simply classified as follows:

TYPES OF POOR SCARS

a. Movement scars.
b. Tension scars.
c. Depressed and fixed scars.
d. True keloids.
e. Hypertrophic scars (pseudo-keloids).

The most important and most common of these is the hypertrophic scar; therefore, only brief reference will be made in this report to the other types of scarring.

1. *Movement scars.*—Movement is a well recognized factor in the production of thickened scars which do not occur as a result of true hypertrophy. They are raised above the surface, particularly when crossing a concavity. They are not abnormally vascular and do not tend to regress, but to persist as tight bands of adult fibrous tissue, the epithelial covering of which is frequently keratotic. Movement tends to produce cracking which is followed by ulceration. The increasing amount of scar tissue produced in healing creates a vicious circle.

2. *Tension scars.*—Unrelenting mild tension such as that placed on a scar at right angles to Langer's lines often results in a gradual widening without surface breakdown. The end result is a flat atrophic shiny scar which may be almost as wide as the original surgical defect.

3. *Depressed and fixed scars.*—Depressed and fixed scars are the result of almost purely physical factors which result in fixation to underlying rigid structures such as bone, muscle or the trachea. They are more directly related to the location and degree of trauma than to skin lines and they may be remedied by removal of the unyielding fibrous tissue and the interposition of soft padding such as fat between the skin and the underlying fixed structures.

4. *True keloids.*—True keloids occur frequently in Negroes but are rarely seen in other races. Up to the end of the first month, they are indistinguishable clinically and microscopically from hypertrophic scars. A history of keloid formation in former scars may be of value. The true keloid does not regress and it may continue to increase in size over an almost indefinite period and extend beyond the confines of the original scar (Fig. 1).

5. *Hypertrophic scars (pseudo-keloids).*—This type is the commonest type of poor scar, and may be seen after surgical incisions, accidental lacerations, deep second degree burns and indeed almost any form of skin damage. The scar passes through a series of recognizable phases and though these vary in duration and in degree, the pattern produced is quite constant (Fig. 2).

Clinical phases of hypertrophic scars

Primary healing occurring in three to five days results in a faintly pink line on a level with the surrounding skin. In the next 20 to 30 days, the scar increases in width and prominence, the pinkish colour becomes more marked and the surface becomes shiny and has a "moist" appearance. It is almost always described by the patient as "very itchy".

Up to this point a hypertrophic scar is identical histologically and clinically with a true keloid.

The hypertrophic scar undergoes a series of changes which may occur over a period of six to 60 months in untreated cases. During this time it loses its "moist" appearance, the reddish-pink colour fades, it decreases in bulk and prominence and finally becomes a thin, white, flat, slightly wrinkled scar.

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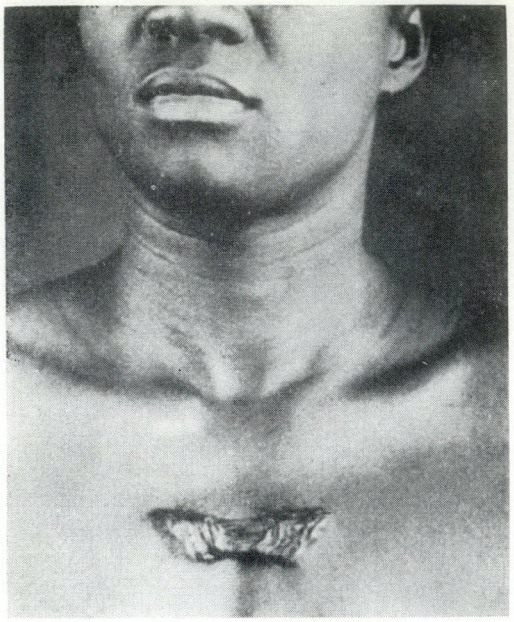

Fig. 1a

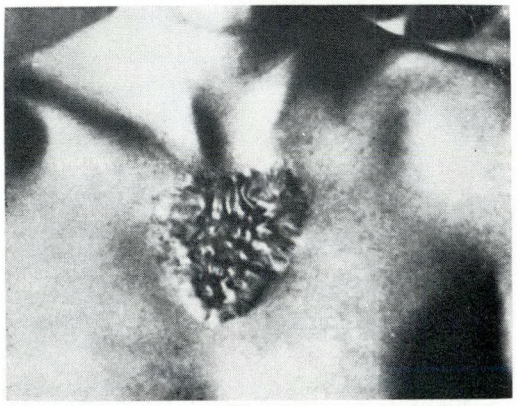

Fig. 1b

Figs. 1a and b.—True keloids occurring spontaneously in the classical pre-sternal location in young Negro woman. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

Factors that Influence the Type of Scar Formation

1. *Types of skin—"Keloid formers".*—Negroes and reddish haired people have long been recognized as individuals with a tendency to form poor scars. Those with thyroid dysfunction and endocrine disturbance are prone to exhibit similar changes. Children with a lot of lanugo hair ("baby hair"—"baby fuzz") are noteworthy in this regard. Lastly, a miscellaneous group of persons who do not fit into any of the foregoing categories are equally likely to present the same problem. These groups will be discussed later in this paper, in the light of recent knowledge.

2. *The problem of Langer's lines or wrinkle lines.*—In 1861, Langer,[1] an Austrian anatomist, published his monumental work on the subject of lines of skin tension (Figs. 3 and 4). Kocher in 1892, suggested that surgical incisions should follow Langer's lines and in 1907 published the description of his classical incisions drawn over these lines.[2] In 1935, Webster[3] recorded his disagreement with Kocher's advocacy of vertical incisions across joints, and midline incisions, and expressed the opinion that natural wrinkle lines are much more advantageous sites for skin incisions. In 1947, Shaw and Copenhaver[6] published an excellent review of the subject, and presented the results of their original research which clearly demonstrated that in most areas the majority of fibres of connective tissue follow patterns similar to those of Langer's lines. More recently Kraissl,[11] in an excellent article published in 1951, reviewed and challenged Langer's and Kocher's concepts and emphasized that wrinkle lines are frequently more important than the classical Langer's lines (Figs. 5, 6 and 7). Quoting Webster, Kraissl observed that "The simplest rule for making incisions in the most favourable direction is to follow the natural wrinkle lines. These are usually recognizable in the face, the neck, at the wrist, the axilla, the groin, or the back of the knee". Conway[4] in 1938 noted the differences in physiologic elasticity in the same areas of the body between live subjects and the cadavers on which all the early work was based.

Kraissl makes a fundamental observation when he says "It is evident that these (wrinkle) lines fall in a pattern across the muscles perpendicular to their action" (Figs. 7, 8, 9, 10 and 11).

The excellent diagram of elective surgical incisions of the hand published by Bruner[7] in the British Journal of Plastic Surgery and illustrated in Fig. 13 is worthy of note.

3. *Primary healing.*—It is universally agreed that primary healing of any wound produces a minimal amount of scarring.

4. *Infection.*—Gross infection, resulting in healing by secondary intention, which is always delayed healing, is followed by the laying down of excessive fibrous tissue.

5. *Tension beyond physiological limits.*—Closure of a wide wound under considerable tension often results in strangulation of blood supply by the sutures, necrosis of the wound margins and subsequent secondary healing.

6. *Motion.*—"Rest of the part" at the time of wound healing is of the utmost importance. Later, after healing, physiological motion, such as the tension on the skin of web spaces in abduction of fingers, can cause perpetuation of heavy scarring. If the skin tension is relieved by the addition of skin without removal of all of the old scar, the latter will usually regress without further therapy.

7. *Keratin sensitivity.*—The experimental animal studies of Glücksmann[9] at Cambridge, which were corroborated clinically by Mowlem[8] indicate that the presence of keratin in a wound may well be an important factor in the production of hypertrophic scar formation. These observations constitute the most significant and outstanding recent contribution to the literature on this subject. After implantation of small autogenous grafts beneath the skin of laboratory animals, these workers observed that "so long as the keratin produced by the graft and its contained hair follicles remained encysted no tissue response to the presence of the implant was discernible. As soon, however, as the cyst wall perforated exposing the subcutaneous tissue to the effect of the keratin, there was a dilatation of those vessels in the immediate neighbourhood, with perivascular infiltration of round cells. The process continued until the keratin had been removed by the normal scavenging mechanism."

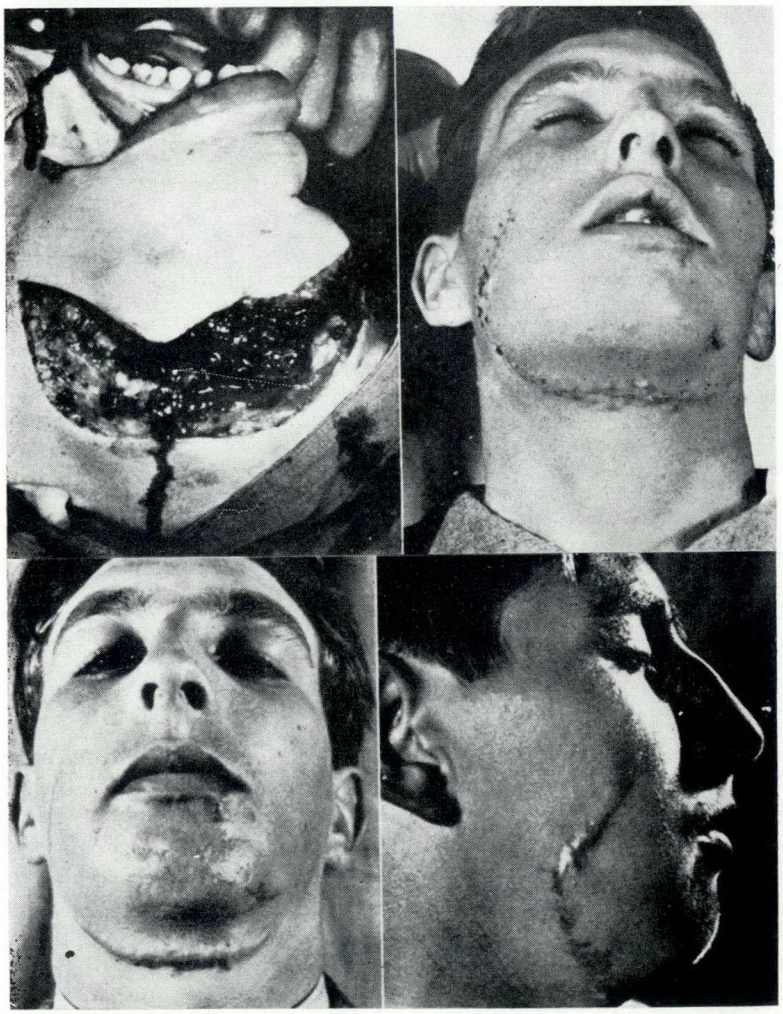

Fig. 2.—A laceration developing to a hypertrophied scar in a young man with abundant facial growth of lanugo hair. (Courtesy of Mr. Rainsford Mowlem. Reproduced by kind permission of the British Journal of Plastic Surgery).

Mowlem has demonstrated clearly the close relationship between these histological changes and the commonly observed cycle of changes through which a hypertrophic scar passes.

Keratin Factors

(a) *Systemic.*—It is reasonable to assume that the majority of wounds at some stage contain some foreign material, yet all do not form hypertrophic scars. It is also reasonable to assume that the amount of keratin buried within the wound will vary, as will the individual systemic reaction to keratin. However, the systemic factor will be constant in any individual patient. Clinically, one observes that two scars in the same patient do not produce similar and equal responses.

(b) *Local.*—The local response is confined to the region of the blood vessels which are exposed to the effects of the keratin (Fig. 12).

Sources of Buried Keratin

1. *Lanugo hair.*—Lanugo hair is the fine abundant baby hair or "baby fuzz" which is often present in great quantity. Mowlen emphasizes its fineness, the great numbers of individual hairs, their slow growth and most important, the *obliquity* of their growth. Therefore, the number of buried hair follicles will depend on whether the incision is parallel to, or at right angles to, their general direction. Beard or scalp hair is much less dense and grows more vigorously and rapidly so that most hair follicles of this type will only be temporarily buried.

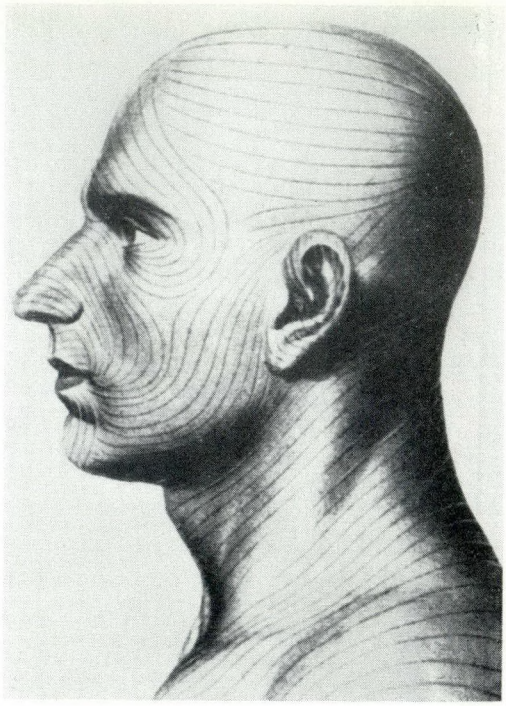

Fig. 4.—Classical Langer's lines of the head and neck. (Courtesy of Dr. C. J. Kraissl after Langer. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

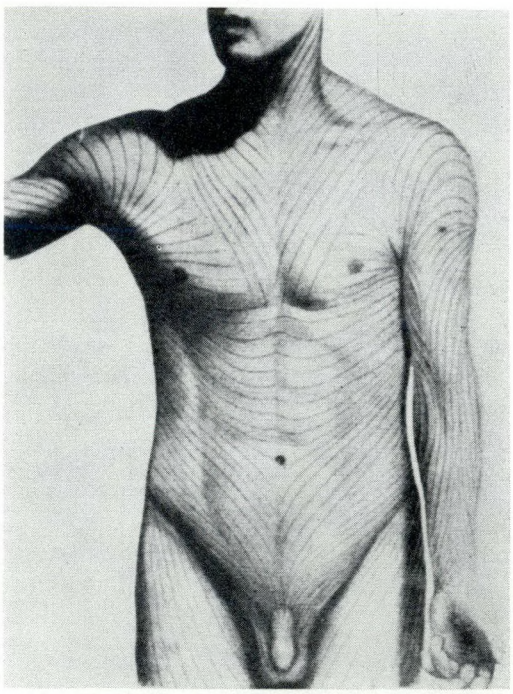

Fig. 3.—Classical Langer's lines of the anterior body. (Courtesy of Dr. C. J. Kraissl after Langer. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

2. *Sebaceous glands and sweat glands.*—Both sebaceous and sweat glands are rich sources of abundant keratin. It is noted clinically that areas that show profuse sweating, such as the palms of the hands, have a tendency to hypertrophic scarring.

3. *Skin thickness.*—It seems reasonable to assume that the chance of burying these skin appendages is proportionate to the thickness of the skin. This assumption is borne out clinically, as it is rare to see a hypertrophic scar in the skin of the eyelids, an area of the body in which the skin is thinnest.

Types of People—Bad Skin

It seems reasonable, therefore, to recategorize people with "bad skin" in the light of this new knowledge.

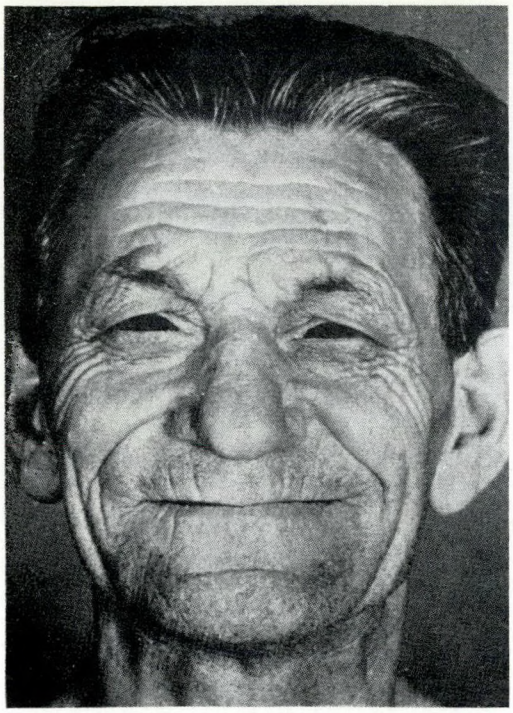

Fig. 5a

1. *Individuals with red hair and fair complexion.*—These persons usually have an overabundance of lanugo hair.

2. *Individuals with thyroid or endocrine disturbance.*—Such people have coarse skin with excessive terminal hair and an active sebaceous gland mechanism.

3. *Negroes.*—Characteristically, Negroes have an oily skin with many active sweat glands. Mowlem suggests that African tribal marital selection, based on the presence of keloid scars, could accentuate the systemic factors in these individuals.

4. *Children.*—Many children have an abundant amount of lanugo hair. This is particularly noteworthy in the case of prepubertal boys.

5. *Adults.*—There are certain adults who do not fit into any of the aforementioned groups. However, one can frequently find evidence to suggest that the presence of keratin from some source is a factor contributing to hypertrophic scar formation in such individuals.

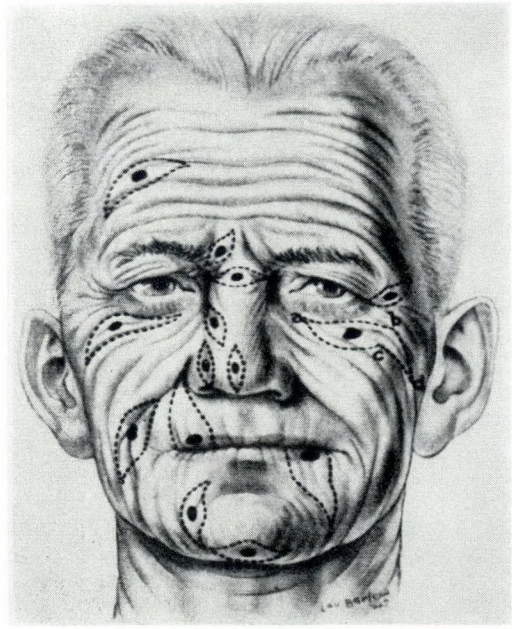

Fig. 5b

Figs. 5a and b.—A case photograph and its drawing with appropriate lines for excision of various lesions superimposed on the wrinkle pattern. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

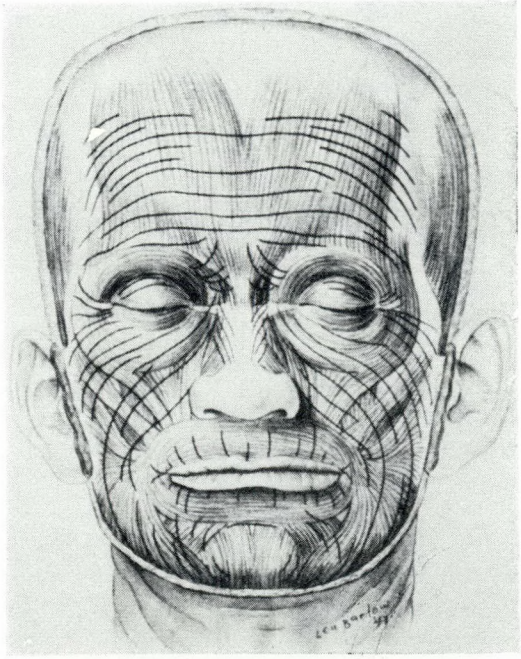

Fig. 6.—The same wrinkle pattern superimposed on a diagram of facial musculature demonstrating that wrinkle lines occur at right angles to the direction of pull of muscles. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

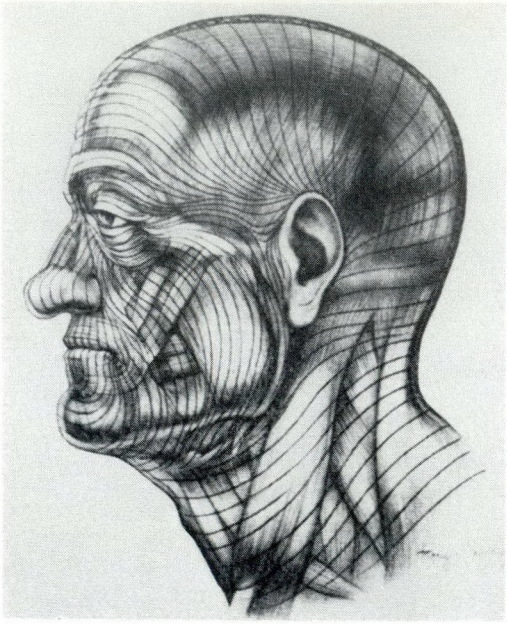

Fig. 7.—Wrinkle lines of the side of the head and neck. Contrast this with Langer's lines (Fig. 4). (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

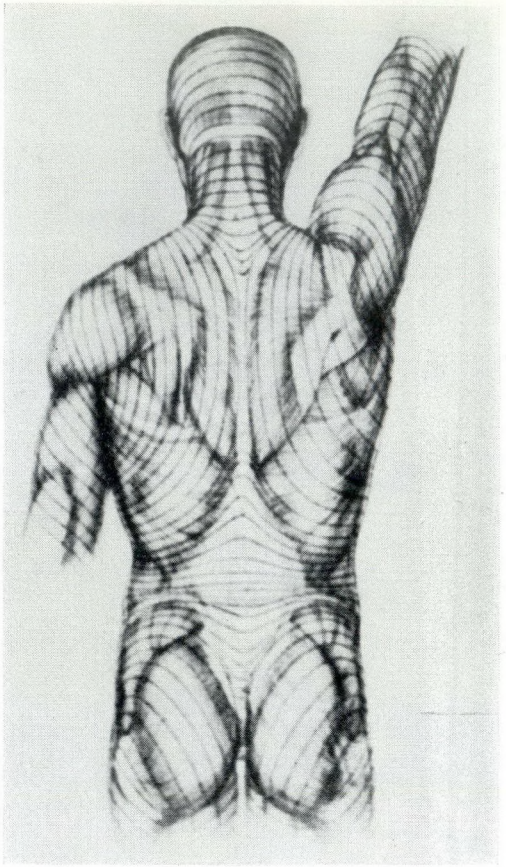

Fig. 8.—Wrinkle lines of posterior body. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

Control of Hypertrophic Scars

The following measures are suggested with the objective of reducing the possibility of hypertrophic scar formation.

1. In elective surgical procedures, select the proper wrinkle lines for incisions.

2. In the case of a traumatic wound that does not follow wrinkle lines, debride it carefully, convert it to proper wrinkle lines if possible, but above all strive for clean primary healing.

3. Do not use vertical incisions across flexion creases, but follow the wrinkle lines (flexion creases) and extend the incisions vertically where necessary, in areas where they are not subjected to extremes of tension and movement.

4. Avoid the inclusion in wounds of such foreign material as wisps of cotton from sponges, powder from gloves, or dirt from the road. It is of equal or even greater importance, in elective surgical procedures, to avoid the inclusion of keratin-forming skin appendages by skiving or irregular incisions, overlapping edges and so on.

5. In the case of children, avoid or delay non-essential operations where possible because of the tendency of their lanugo hair factor to produce heavy scars.

Treatment of Hypertrophic Scars

Once developed, hypertrophic scars may require treatment owing to associated itching or burning pain, interference with function or unsightly appearance. Even though circumstances surrounding the healing of the original wound did not favour clean primary healing, the latter may be achieved in some cases after simple surgical excision or revision to remove excessive fibrous tissue. However, under many circumstances a purely surgical approach will result in the ultimate formation of a scar of the same, or even larger size, because some of the aforementioned factors can not be adequately eliminated. In these situations radiotherapy may be of value. The objec-

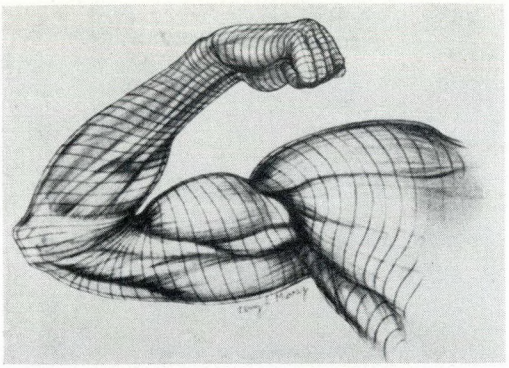

Fig. 9.—Wrinkle lines of the upper extremity when flexed. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

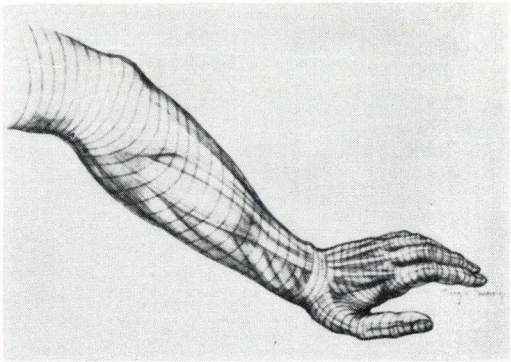

Fig. 10.—Wrinkle lines of the upper extremity when extended. (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

tive of such radiation is to make the keloid or hypertrophic scar smaller, softer, flatter and less obvious, more quickly than if resolution is allowed to occur without treatment. Very often the relief of itching and burning can be achieved quite promptly by this means. Because it induces softening, radiation may lessen the extent of minimal contractures but will not appreciably affect more extensive types. Where

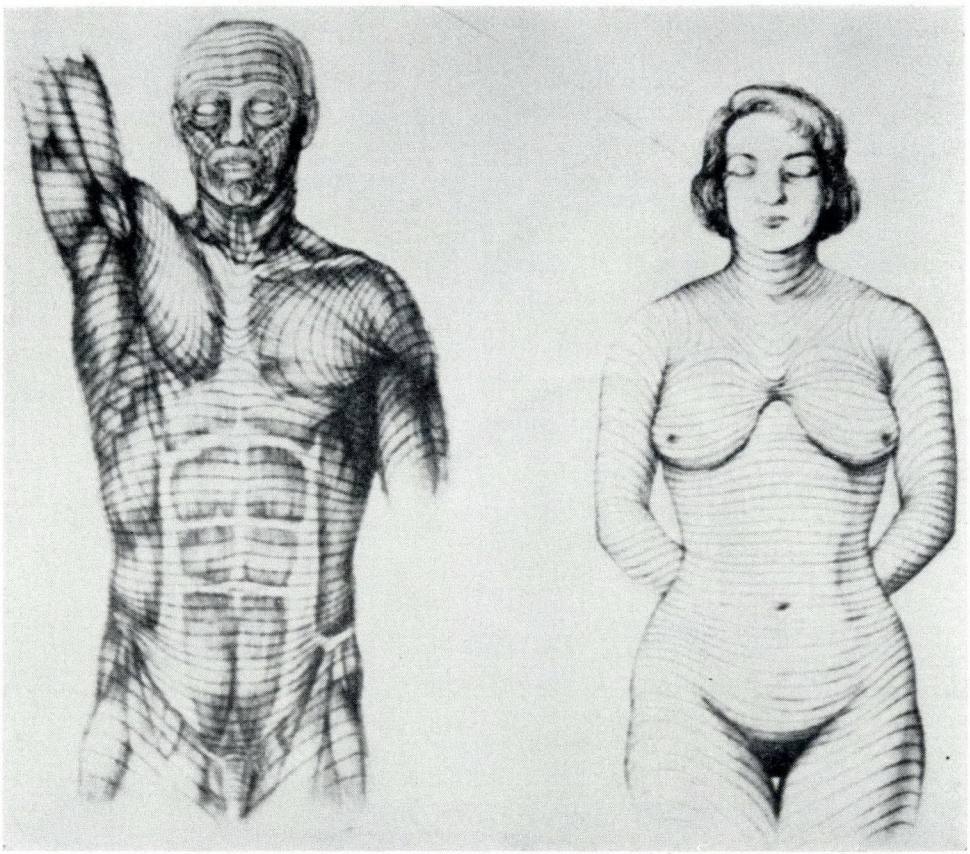

Fig. 11.—Wrinkle lines of the anterior body, male and female. Contrast this with Langer's lines (Fig. 3). (Courtesy of Dr. C. J. Kraissl. Reproduced by kind permission of the Journal of Plastic and Reconstructive Surgery).

Fig. 12.—Foreign body reaction and perivascular round cell infiltration in the vicinity of a buried hair. (Courtesy of Dr. A. Glücksmann. Reproduced by kind permission of the British Journal of Plastic Surgery).

recurrence is a likely possibility, notably in the treatment of true keloids, radiation before and after operation will most often facilitate successful surgical excision. It is strongly emphasized, however, that care must be taken to avoid such postradiation sequelae as radiodermatitis and malignancy. High doses of radiation, delivered over a short period of time, are contraindicated. Such ill-advised therapy results in radiodermatitis and local tissue changes that make subsequent surgery more difficult, and also interfere with both bony and soft tissue development in the growing child.

In our approach to this problem we have adopted the policies followed by the plastic surgery and radiotherapy services of the Presbyterian Hospital, New York. The radiotherapeutic problems involved are well illustrated in a comprehensive article by Hunter,[5] based on 20 years' experience, between 1922 and 1942. Experience with the use of radiotherapy has now accumulated over a 37-year period. One of us (J. W. McNichol) has followed this routine over a period of 18 years. The results have been gratifying and the problem of radiation dermatitis has not been encountered.

The value and importance of the team approach to this problem cannot be emphasized too strongly. As a result of consultation by the various members of the team, it may be decided that certain patients should be treated by radiotherapy only, while others should be treated by radiotherapy and operation.

Should radiotherapy alone be indicated, the following program is recommended.

One treatment is given every two weeks to a total of four doses. After a three-month period of observation, a second course of radiotherapy is administered in whole or in part depending on the patient's response and the radiotherapist's judgement.

If radiotherapy is to be combined with operation the following procedure is recommended: one course of roentgen therapy is administered as above, the area radiated including the skin to be incised if the lesion is a true keloid. Immediately after the last radiation treatment the scar is excised. As soon as the wound is healed and the sutures are removed, a second course of radiotherapy is administered.

The following radiotherapy technique is recommended by Hunter. The scar is outlined with a pencil on tracing paper, the tracing is transferred to lead foil and the latter is then cut out 3 mm. to 5 mm. beyond the outline of the scar so that a rim of normal tissue will be exposed when the lead foil is used as a shield during radiation treatment. The average radiation dose recommended is 200 r (130 Kv. p) using a 3 mm. aluminum filter. For thin scars the recommended dose is 140 r (100 Kv. p) with no filter.

Suture Marks

Lacerations which should leave relatively inconspicuous scars are often exaggerated to the point of appearing hideous, due to the formation of many transverse suture marks. The following factors influence the formation of such suture marks:

1. *Type of suture.*—Suture materials that cause irritation, such as catgut, will result in more scarring than bland sutures such as wire, nylon or silk.

2. *Size of sutures.*—The size of the suture makes very little difference if it is used

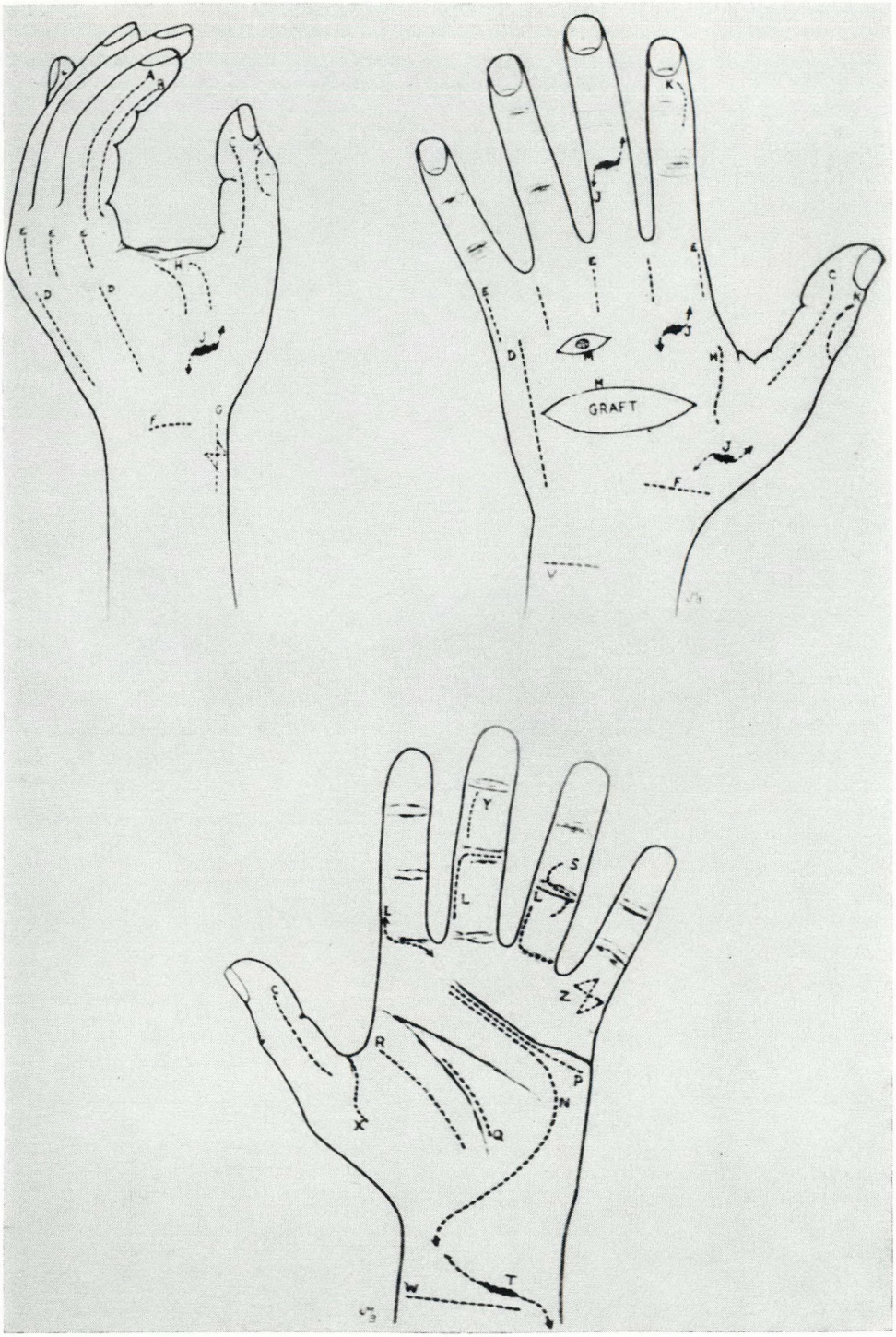

Fig. 13.—Proper incisions for surgery of the hand. (Courtesy of Dr. Julian Bruner. Reproduced by kind permission of the British Journal of Plastic Surgery).

properly, but if used improperly, the larger the stitch the larger will be the mark it leaves.

3. *Tension of sutures.*—This is probably the most important factor of all. If sutures are too loose, the edges of the incision are not approximated. If they are too tight, necrosis of the strangulated tissue occurs with resulting increase in scarring by secondary healing.

4. *Infection.*—Infection around the sutures is an obvious cause of increased scar formation at suture sites.

5. *Downgrowth of epithelium.*—This phenomenon, occurring about the suture material, may result in the formation of pits, or occasionally of skin tunnels.

Summary and Conclusions

Undesirable scars are of varying types, the most common of which is the hard, itchy, tumour-like hypertrophied scar.

The actual importance of classical Langer's lines is overemphasized and these are very difficult to remember.

Natural wrinkle lines are a much more reliable guide to good incisions and are almost always very easy to check, even while the knife is poised.

In traumatic surgery, where lacerations do not respect so-called "good lines", the surgeon should make the most of wrinkle lines where possible and rely on meticulous surgical technique to minimize scarring.

Where gross hypertrophy appears imminent a competent radiotherapist should be consulted.

Acknowledgments

Mr. Rainsford Mowlem, Mr. A. Glucksmann and their staffs generously permitted reference to their previously published fundamental works. The authors also express their appreciation to Dr. C. J. Kraissl and Dr. J. M. Brüner for permission to reproduce illustrations from their publications, and to Dr. A. F. Hunter.

We are grateful to Miss Jo Ann Ashley for assistance in preparing the photographic illustrations and to Mrs. Morski and Mrs. Margaret Watson for their secretarial help.

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Résumé

Il est de la plus haute importance d'éviter la formation de mauvaises cicatrices. Celles-ci peuvent être cataloguées en cinq types principaux: 1. Les cicatrices entravant un mouvement qui, à la tension vont se déchirer et provoquer ensuite un ulcère; de cette façon, l'augmentation progressive de tissu cicatriciel crée un cercle vicieux. 2. Les cicatrices avec tension, généralement provoquées par des incisions perpendiculaires aux lignes de Langer. 3. Les cicatrices fixées à la profondeur, dues à l'existence d'adhérences entre la peau et les parties profondes, os ou muscles. 4. Les chéloïdes vraies, surtout fréquentes chez les individus de race noire. 5. Les cicatrices hypertrophiques, qui sont de beaucoup les plus fréquemment rencontrées; on les appelle également pseudo-chéloïdes; elles succèdent aux déchirures accidentelles, aux brûlures profondes et aussi aux incisions chirurgicales.

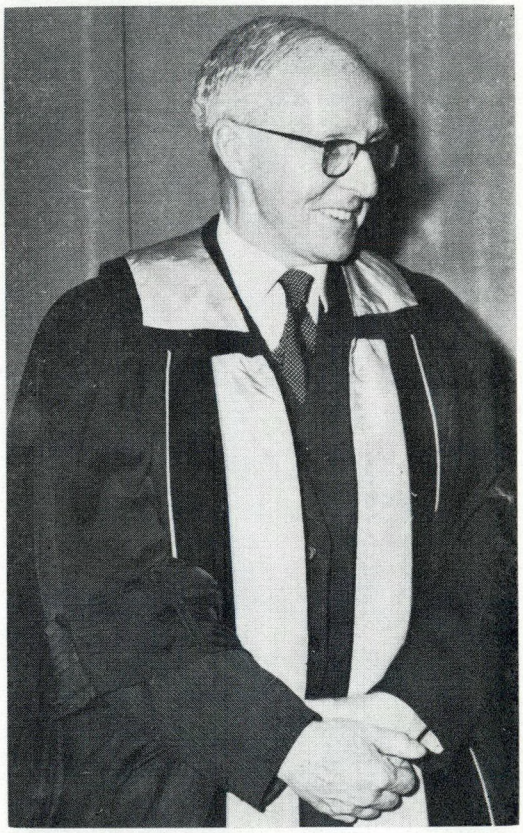
Dans la suite de l'article, les auteurs insistent sur l'importance des lignes de Langer; celles-ci sont cependant difficiles à retenir et il est souvent plus commode de se référer à un système plus simple selon les rides cutanées. Il est évident que les traumatismes ne respectent pas les "bonnes lignes": le chirurgien devra alors faire tout son possible pour réduire au minimum la surface cicatricielle en se basant sur les lignes des rides. Les cicatrices hypertrophiques pourront être avantageusement soumises à la radiothérapie; il faudra dans ce cas protéger les parties alentour par un écran de plomb soigneusement ajusté sur les bords cicatriciels.

SPECIAL COMMUNICATIONS

CANADIAN VISIT: REPORT OF THE FIRST McLAUGHLIN-GALLIE PROFESSORSHIP

C. F. W. ILLINGWORTH, M.D., *Glasgow, Scotland*

The Royal College of Physicians and Surgeons of Canada at its annual meeting in January 1960, established an Educational Endowment Fund. The College was most fortunate to receive from the McLaughlin Foundation a generous pledge for an annual grant of up to $6000 to provide for the visit of a distinguished guest teacher or investigator to one or more Canadian Medical Schools. The fund was established by Mr. R. S. McLaughlin as a tribute to the memory of the late Professor W. E. Gallie and the tour of the guest lecturer is to be known as the R. S. McLaughlin-W. E. Gallie Visiting Professorship. Professor Charles Illingworth, Regius Professor of Surgery, the University of Glasgow, was invited and consented to come to Canada as the first recipient of the lectureship. We are privileged to publish a short account of his experiences and impressions of this occasion.



Dr. C. F. W. Illingworth, Regius Professor of Surgery, University of Glasgow.

IT WAS A great privilege to be the first R. S. McLaughlin-W. E. Gallie visiting professor, and I am glad to be offered this opportunity of giving an account of the visit, which occupied six weeks in the autumn of 1960. During this time my wife and I spent nearly two weeks in Vancouver and a similar period in Winnipeg, with short visits also to Kingston, Ottawa, Toronto and Montreal. Needless to say we met with great kindness and hospitality everywhere, renewed many old friendships and made many new ones. It is no polite fiction but sincere truth that we enjoyed every minute and were sorry when the time came to leave.

I am sure that it was a wise decision on the part of the Canadian Royal College to suggest that we should spend the greater part of the time in two centres, even though it meant missing entirely several of the Canadian medical schools and permitted only brief visits to others, for this plan enabled me to enter fully into the medical life of Vancouver and Winnipeg, to meet nearly all of the clinical teachers and most of the resident and intern staff and undergraduates. I should think that much of the benefit to be expected from the visiting Professorship must come from close contacts of this sort, and for my own part they were the most enjoyable features of my tour.

I should like to express my thanks to those who were responsible for arranging our programs, particularly Dr. Allan McKenzie and Dr. Colin Ferguson and the members of their departments. I know well

what a great deal of trouble is involved in planning a timetable of this sort, involving lecture times, meetings, visits to other hospitals, contacts with many colleagues, and so on, and to superimpose this upon routine hospital duties.

The program they arranged was indeed a kind of royal progress, with a minute by minute schedule of visits, interviews, lectures and off-the-cuff commentaries, and an occasional brief interlude for refreshment or reflection. Altogether, it was quite arduous but immensely stimulating.

It has been suggested that I should take this opportunity of giving my impressions of surgery in Canada as compared with that in my own school. I am well aware of the fallacies of an impression gained in a brief visit. The fact that I was involved in, on the average, three seminars or teaching rounds or conferences a day, and was invited to a social party seven evenings a week, testifies to Canadian hospitality but not to the normal Canadian way of life. The fact that every operation I saw performed was for valvotomy or a septal defect does not imply that Canadian surgeons never treat hernia or gallstones.

The conditions under which surgery is practised in the two countries are also so different that it is hazardous although tempting to make comparisons. In Glasgow and indeed in the United Kingdom generally, people of all social classes come into the ordinary wards of the main teaching hospitals, making the best of the rather primitive conditions and the lack of amenities which still characterize our outdated hospitals, and as a rule they are content to receive treatment, whether at the hands of staff men or registrars or interns, on the general expectation of getting the best treatment appropriate to their particular needs. In Canada, on the other hand, patients are accustomed to the better conditions available in your more modern hospitals and they prefer greater privacy, while as to their medical attention, it is my impression that they prefer to select and pay their own surgeons or physicians and, as a corollary, expect them to give their detailed personal attention throughout the whole course of the treatment.

It seems probable that these differences will become more marked with the passage of time. In the U.K. there is an increasing tendency for patients who formerly paid for treatment in our admittedly inefficient nursing homes to seek admission to the ordinary wards of the main hospitals. In Canada the opposite tendency is evident, at least in some centres, where patients who hitherto would have been treated in the staff wards tend more and more to be regarded as semiprivate or private cases. This trend, if it continues, will obviously have repercussions on the facilities for medical education, as indeed is already beginning to be evident in some of the schools.

Nevertheless, despite these contrasts, I was more impressed by the similarities than by the differences between my own school in Glasgow and the Canadian centres I visited. Fundamentally our attitude towards our patients and our approach to treatment are much the same, while our views on teaching and research are not greatly different. We in the U.K. like you in Canada, tend to be rather conservative in assessing new methods of treatment. In our diagnosis and ward care, while making full use of laboratory techniques, we, like you, also appreciate the value of clinical judgment and experience. In our research laboratories we are similarly concerned with basic problems as well as with operation techniques.

The problems of current interest to surgeons are much the same in the two countries and I was interested to see how close our thinking is, even on matters which are in a state of flux and change. For example, in breast cancer, the high failure rate of orthodox methods of treatment is now universally acknowledged and there is general agreement that the endocrine ablations, while they give gratifying remissions in a proportion of cases, are less beneficial than our earlier optimism led us to expect. In both countries at the present time active research is going on to explore the potentialities of the antimitotic and cytotoxic agents though with little immediate prospect of success.

It is true that there are some minor differences in surgical problems in the two countries. In my visits to Canada and also

to the United States I am always impressed with the frequency with which chronic pancreatitis comes up as a subject of discussion, whereas in the U.K. we regard it as something of a rarity. We can probably disregard flippant conjecture as to the relative etiological significance of rye and scotch but if there is any real difference in the incidence it would be very interesting to explore the subject further. Conversely perforated peptic ulcer is not often mentioned in Canada whereas in the U.K it is an ever present problem.

The problem of wound sepsis is certainly a very topical one in both countries. This is not a new problem and I do not think it is increasing. Almost certainly there was much more wound sepsis formerly than at the present time but in those days it was accepted as an inevitable feature of surgical work whereas now we are more critical and with better bacteriological services we can estimate its frequency and trace its routes of spread more accurately. In Canada, as in the U.K., the problem is being tackled vigorously and I was much impressed by the energetic measures being taken in one or two Canadian centres to control its incidence.

One of the most enjoyable features of my visit was provided by the frequent opportunities to take part in undergraduate teaching and graduate training programs. It is difficult to compare your educational methods with our own as the basic conditions are so diverse. I think it is probably still true on the whole that in the U.K. generally the teaching is more didactic, with more formal lectures, more note taking and more written examinations. However, there are some exceptions to this generalization and my own unit in particular follows Canadian practice more closely in this respect. Consequently I felt completely at home in the teaching rounds in Vancouver, in Winnipeg and the other cities I visited and I enjoyed the contacts with the students enormously.

Graduate teaching, contrariwise, tends to be more fully organized in Canada than in the U.K. where only a few hospitals such as my own have so far instituted a regular "Registrar rotation" service, and so far as I know there is nothing on this side at all comparable, for example, to the very thorough graduate training scheme which I saw in Winnipeg.

At this point I should like to take the opportunity of commenting on the work carried out by the residents and interns of the staff wards of the centres I visited. It seemed to me that they were carrying out their responsible duties with great assiduity and ability. I had few opportunities of comparing the standard of treatment given to private patients but I find it difficult to believe that it could be any better. In the centres I visited the resident work was well supervised and while the individual responsibility given to residents was greater than is usual on this side I got the impression that the men chosen for these posts were well able to carry the extra load of responsibility. Certainly I am in no doubt that with proper supervision a good teaching unit in Canada as in the U.K. offers the best facilities for good treatment.

It was very pleasant in the course of our tour to have the opportunity to visit the fine new building of the Royal College in Ottawa, where Dr. Graham and his staff made us very welcome, and where I had the privilege of transmitting a message of greeting, and a token of friendship in the shape of a gavel, from our own ancient corporation, the Royal Faculty of Physicians and Surgeons of Glasgow. Note that these two bodies include within their members both physicians and surgeons and indeed practitioners of every branch of medicine. I am sure this is a good plan. Medical care is indivisible and the division between physicians and surgeons is quite artificial. Certainly there is a great deal in common between general surgeons and internists, between cardiologists and those who perform heart operations, between neurosurgeons and neurologists. In Glasgow the bonds are becoming closer rather than laxer, as is shown in our joint "grand rounds" and research seminars, and I am interested to see the same tendency developing in Canada.

One of the last engagements on my tour was a dinner party at the house of Mr. Sam McLaughlin, whose name is associated with the late W. E. Gallie in the

Visiting Professorship which I held. It was a very pleasant occasion, and particularly delightful to see that a great industrialist can still take such a personal interest in medical affairs, and even in the doings of every individual Fellow supported by his Trust. I had met many ex-Fellows in the course of my tour and there is no doubt of the value which the Trust is giving, through them, to Canadian surgery in general. I hope that in the future more of them will elect, in their year as McLaughlin Fellows, to visit my unit in Glasgow, where they can be assured of a warm welcome as well as, I believe, a profitable experience in clinical work or research.

Résumé

Le Dr. C. F. W. Illingworth est le premier récipiendaire de la bourse McLaughlin-Gallie. Cette nouvelle fondation se propose de permettre l'organisation de visites au Canada de professeurs étrangers éminents. Le Professeur Charles Illingworth est professeur de Chirurgie à l'Université de Glasgow.

Après avoir remercié les organisateurs de son voyage, le Dr. Illingworth donne ses impressions sur la chirurgie au Canada. Il souligne que, d'une façon générale, les hôpitaux de Glasgow, plus anciens que les hôpitaux canadiens, se trouvent être moins confortables; le malade canadien est certainement habitué à plus de modernisme et il se fait plus volontiers traiter en privé. Ces différences iront sans doute en augmentant; ceci risque évidemment d'avoir des répercussions sur les possibilités d'enseignement, de par la diminution progressive des cas publics. Il y a par contre peu de différences entre les médecines canadiennes et anglaises en ce qui concerne l'attitude du médecin vis-à-vis du malade et l'organisation des traitements. Ici et là, on utilise de la même façon les techniques de laboratoire.

Les problèmes scientifiques qui intéressent le plus les chirurgiens des deux pays sont les mêmes: dans la lutte contre le cancer, tout le monde travaille actuellement sur les drogues antimitotiques. Il est curieux de noter une incidence et une fréquence beaucoup plus forte de pancréatites chroniques sur le continent américain.

En ce qui concerne l'enseignement, gradué ou pré-gradué, l'auteur pense que les méthodes utilisées en Angleterre sont plus conservatrices: il y a plus de cours ex cathedra, plus de notes à prendre et plus d'examens. L'enseignement post-gradué est plus developpé ici.

ROSE AND CARLESS MANUAL OF SURGERY. Consulting Editor Sir Cecil Wakeley, Bt., K.B.E., C.B. Edited by Michael Harmer and Selwyn Taylor, assisted by 15 contributors. 19th edition. 1389 pp. Illust. Ballière, Tindall and Cox, London, 1960. $14.25.

For over 60 years undergraduate students as well as graduates studying for their Fellowship have made use of this book in their studies. It has generally been considered to contain more information than any comparable textbook in surgery.

It is a particularly comprehensive book as it has been in the past. It is different from most general surgical textbooks in that it includes sections on ophthalmology, otolaryngology, gynecology and tropical surgery.

The present edition has been published in one volume and this has many obvious advantages. The deletion of the chapter on anesthesia will not detract from it, inasmuch as there are now many textbooks in anesthesia which may be consulted. Another pleasing feature has been the incorporation of a brief biography of the two original authors. This will meet with the approval of those who have an interest in the history of surgery.

The first chapter deals with the general principles related to infection, shock, electrolyte disturbances, wounds, burns, chemotherapy, blood transfusions and similar topics. It has been brought completely up to date with the latest information concerning advances in the care of the surgical patient.

Subsequent chapters are devoted to the surgery of the different organs and systems. Each subject is dealt with in an orderly fashion, first outlining the pathology or altered anatomy, signs and symptoms, diagnosis and treatment. Detailed discussion of the techniques of operations is not provided but the general principles are outlined.

It is a great tribute to any book that it is still in use 60 years after publication of the first edition. With this new edition, Rose and Carless will be assured of a permanent place in all medical libraries and reading rooms. It is one of the most up to date and complete works in surgery. It will be particularly helpful to medical students, practising surgeons and any who wish to consult an excellent surgical textbook.

TRIBUTE TO THE MEMORY OF SIR GORDON GORDON-TAYLOR, K.B.E., C.B., M.D., Hon. LL.D., Hon. Sc.D., M.S., F.R.C.S., Hon. F.R.C.S.(Ed.), Hon. F.R.C.S.(I.), Hon. F.R.C.S.[C], Hon. F.F.A.R.C.S.

JOHN LAING McDONALD, M.B., F.R.C.S.[C], *Toronto*

IT IS WITH a feeling of deep humility that I perform this labour of love by attempting to pay my personal tribute to this great man whom I loved and admired so much. "G.T.", as he was affectionately known by his students and house surgeons, was a brilliant classical scholar and a master of the English language. His many surgical contributions, published in various medical and surgical journals throughout the world, and his numerous tributes paid to departed friends and colleagues, were written with a phraseology and beautiful choice of words which were like soft music to the highly sensitive ear.

Already many fine tributes to Sir Gordon Gordon-Taylor have been written by his former students and house surgeons. These

SIR GORDON GORDON-TAYLOR

The above is a photograph of a recent portrait by JAMES GUNN, R.A., commissioned by the Australasian College of Surgeons and now hung in the home of the College in Australia.

I wish to acknowledge my deep appreciation to the artist for granting permission to publish it in the *Canadian Journal of Surgery*. J.L.McD.

have given a sketch of the early life, academic achievements and the many honours that have been conferred on this brilliant man. I shall attempt to review these but briefly, and to give more time to the man, as viewed through the eyes of a Canadian.

Sir Gordon was born in Aberdeen, Scotland, on March 18, 1878. He was educated at Gordon's College and Aberdeen University where he studied Classics and obtained his M.A. degree with honours in 1898. He was fortunate in having the privilege of obtaining his early training in the University of Aberdeen, one of the greatest centres of learning in the English-speaking world. His later life proved that he must have been one of the most brilliant graduates of that institution.

With the loss of his father early in life, he accompanied his widowed mother and other members of his family to London, where he became a student in medicine at the Middlesex Hospital, from which institution he obtained his M.B., in 1903. From the beginning of his medical career he showed a keen interest in anatomy, winning the medal in anatomy at the time of taking his intermediate examination. With a fellow student and personal friend, Victor Bonney, he then determined to further his knowledge of anatomy by working for the degree of B.Sc. This demanded many hours of labour, well into the night, and both men succeeded in obtaining their B.Sc. in Anatomy with honours. In 1906 he obtained his M.S. from the University of London, and in the same year he became a Fellow of the Royal College of Surgeons of England.

Sir Gordon was appointed to the surgical staff of Middlesex Hospital on the service of Sir John Bland-Sutton in 1908. In 1921 he succeeded Sir John as head of the service and about that time he became Chief Surgeon to the Middlesex Hospital.

During the First World War he served as a surgeon with the R.A.M.C., during which period he made many valuable contributions to the field of military surgery, performing many operations in field ambulances and casualty clearing stations, saving the lives of many severely wounded young men. Sir Gordon's greatest contributions, I believe, during that period, were in the treatment of gunshot wounds of the abdomen. While serving close to the Canadian lines, he met the late Dr. Bruce Robertson who was the first man to successfully carry out blood transfusions to combat shock and loss of blood in the severely wounded. In many of the medical histories written about the First World War, it has been stated that blood transfusions were introduced in the treatment of severely wounded in warfare by the Americans. Sir Gordon was one who stated that blood transfusions were being performed in France in the winter of 1915-1916 by the late Bruce Robertson, long before the Americans had entered the War. Sir Gordon retired from war service with the rank of Major, and was awarded the Order of the British Empire.

Soon after his appointment as Chief of the Service at the Middlesex Hospital, it became the most sought-after service for the surgical training of the undergraduate students, and for the house officers competing for training in surgery. It was my good fortune to be appointed as a house surgeon to G.T. in the winter of 1921-22. This, I believe, was only possible because the most brilliant Middlesex graduate, Dr. Bedford, chose to become a physician, and later became the most outstanding cardiologist of Great Britain. The fact that my father was born in Scotland, within 60 miles of the birthplace of Sir Gordon, also may have proved helpful.

Many pages could be written about the cherished memories I retain of the period spent with G.T., which was one of the most pleasant experiences of my life. During that period, he established his own operating theatre in close proximity to his surgical wards. This made it possible for him to arrange his operating lists as and when he wished. He had regular operating days on Monday and Friday afternoons, using Wednesday afternoon for what he called "clean-up" work.

The nurse in charge of his service, and also the supervisor of his operating room, was Sister Waterman, who was a truly remarkable character. She had served as a Nursing Sister throughout the First World War, and was a plump, jolly soul,

with a rare sense of humour, and I can still recall her hearty laughter. She was devoted to G.T. and she seemed to carry out her heavy responsibilities of efficiently supervising the operating room as well as the Wards, with apparent ease. The operating lists of Monday and Friday were long, and included many of the most major operations in surgery of that day, including thyroidectomies, radical operations on the mouth and neck for cancer, radical mastectomies, partial gastrectomies, and so on, with several attempts at excision of the œsophagus for malignancy. These operations went smoothly, without apparent confusion, and at an appropriate hour in the afternoon we would retire to Miss Waterman's office for tea, to which any visiting surgeons of that day were invited.

Sir Gordon firmly believed in the value of the apprenticeship method of learning surgery, and it was his custom to have his house surgeon perform all the standard operations in surgery under his supervision. He would perform one or more of the various operative procedures with his house surgeon assisting, and as time went on he would reverse the procedure, assisting his house surgeon in similar operations. I feel sure that none of us will ever forget the wonderful training we obtained from G.T. nor the many things we learned about surgery during the tea hour, and at other periods when not actually working in the operating room.

It was the custom of Sir Gordon, whenever his operating list carried one beyond the normal hour of dinner for the house staff – which occurred about once a week –, to say as we left the operating room, "I would like you to hurry, change your clothes and meet me at –", his favourite restaurant. On arrival, a dry Martini would be waiting, and seated at the table would be Lady Gordon-Taylor, a most charming person, with her two sisters. Following dinner, we would move off to G.T.'s favourite place for dancing, where we would enjoy an evening of ballroom dancing, until about 11:30 p.m. Ballroom dancing, I believe, was G.T.'s favourite form of relaxation, and he was a beautiful dancer.

G.T. never owned nor drove a motor car. However, during his active surgical career he always had a Daimler car, with the same chauffeur, on lease from the Daimler Company. He was very fond of walking, and preferred to walk from his home or consulting rooms to and from the Middlesex. He did, however, use the Daimler when travelling to the various nursing homes in London, when performing operations on his private patients. On these occasions he was always accompanied by his house surgeon, who assisted him with the operation, and who always received an envelope with a generous fee enclosed, at the completion of the operation.

Sir Gordon was an examiner in surgery at the University of Leeds, and was a great admirer of Sir Berkeley Moynihan, later Lord Moynihan. During G.T.'s absence from London, while examining students in Leeds, attending meetings, and performing other duties, he left the care of his patients both at the Middlesex and in the various nursing homes, to his house surgeon. I well remember what a thrill it was to be picked up by the Daimler, with the favourite driver, and to make a tour of the various nursing homes in London, which were at that time supported in large measure by G.T. and his patients.

It was Sir Gordon's usual custom to invite his house surgeon, during his period of service, to accompany him as his guest on a visit to Sir Berkeley Moynihan, Surgeon-in-Chief of Leeds Royal Infirmary. There, an operative program would have been arranged previously by Sir Berkeley, and it was a great thrill for me to see that master surgeon in action, and to visit the pathological laboratory closely adjacent to the operating suite, to hear a learned discourse on the pathological material that had just been removed from the previous patient. Such was the modesty of G.T. that, I well remember, on that visit to Leeds, I was introduced to Sir Berkeley as a former house surgeon of Dr. H. A. Bruce, and not as his (G.T.'s) house surgeon.

I recall with pleasure another custom then observed at the Middlesex regarding the relationship of the house surgeon to his chief. It was an unwritten law that the house surgeon meet his chief at the entrance to the hospital. There one would observe G.T. approaching, wearing his

favourite tweed suit with a pink carnation in the buttonhole, walking briskly with his hat at a jaunty angle, complete with cane and gloves. Even in cold weather, he rarely donned a topcoat, and on those occasions, he would carefully move the pink carnation from his topcoat to his double-breasted jacket. After I had deposited his hat, cane and gloves in the cloak-room close by, we would then proceed to the wards or the operating floor. After completion of his duties in the hospital we would return to the entrance where I would return to him his hat, cane and gloves. To me there was a rare charm and dignity associated with this ritual, and I believe we would do well to emulate, in this country, some of the formalities prevailing in the hospitals of London. It would do much to add to the respect and dignity of the medical profession.

Early in his surgical career, Sir Gordon became an examiner in anatomy in the Primary Fellowship Examination of the Royal College of Surgeons, and he continued in this capacity throughout the remainder of his life, in his later years serving as an alternate examiner when for any reason the examiner appointed was unable to be present. I recall G.T. examining me in anatomy in the autumn of 1920. I do not believe one can truthfully say that he looks back with pleasure on any examination, but I well remember G.T.'s courtesy to the students, and the charming way with which he succeeded in putting them at ease.

In 1924 the late Dr. W. E. Gallie gave the Hunterian Lecture at the Royal College of Surgeons of London. He was accompanied on his trip to England by his old friend, the late Dr. D. E. Robertson. Some time before they left Canada I had written G.T. with the request that he put on an operative program at the Middlesex during Dr. Gallie's stay in London. This was the first occasion on which these two outstanding surgeons met, and it was the beginning of a friendship which lasted throughout the remainder of their lives. It was followed by a closer relationship between Middlesex and Toronto, eventually leading to an exchange of professors between these two great medical centres. The present arrangement was worked out between Dean Sir Brian Windeyer of Middlesex, and our Dean, Dr. J. A. MacFarlane of Toronto. This exchange of professors commenced in 1956, and I do hope that it will continue indefinitely.

In 1939 Sir Gordon made his first visit to Toronto to give the Lister Oration to our students of medicine on April 5, the birthday of Lord Lister. This so-called Balfour Lecture was donated several years previously, by Dr. Donald Balfour of the Mayo Clinic, as a gift to his alma mater.

On the occasion of G.T.'s visit to Toronto where we had the pleasure of his company for a period of about one week, he lived as a guest at the York Club, and such was the nature of the man that on each subsequent Christmas, the York Club received a card from Sir Gordon.

It so happened that his visit coincided with the meeting of the Canadian Association of Clinical Surgeons, and part of the programme consisted of a series of operations performed by various Toronto surgeons on the operating floor of the Toronto General Hospital. While driving from the York Club to the Toronto General on the morning of this meeting, G.T. turned to me and said—"Tell me, who is the best surgeon in Toronto?" After some hesitation I stated that we had many good surgeons, and that I thought it would be difficult for me to answer his question directly. However, I said, if you would like me to give you the name of the surgeon that I would like to have operate on me, I would choose Dr. Norman Shenstone. He said "Why?" I replied that in my opinion Norman Shenstone was not only a good surgeon but a man of wide experience and sound judgment and I felt that I would be reasonably safe in his hands. G.T. remarked that he would like to see Dr. Shenstone at work. It was fortunate that among the operations booked for that morning was a total pneumonectomy to be performed by Dr. Shenstone on a patient, who, I believe, suffered from a cancer of the lung. Dr. H. J. Shields was giving the anæsthetic. The operation had proceeded to the point where the chest was opened and the stage was set for the removal of the lung. Before continuing further, Dr. Shenstone noted that the blood

from the incision was a little blue. He turned to the anæsthetist and said—"Harry, are you in trouble?" Dr. Shields stated that he did not like the condition of the patient. Dr. Shenstone then turned to Sir Gordon and said "I am very sorry, sir, that it will be necessary for me to complete this operation on another day," and with that he proceeded to close the chest. As we left the operating room, G.T., with the usual twinkle in his eye, and a slight twitch of the left side of his forehead, turned to me and said—"You know, John, I believe I would like to have that man operate on me."

Sir Gordon was then Vice-President of the Royal College of Surgeons of England, and within a few months an invitation was extended to Dr. Shenstone, from the Royal College, to accept the degree of Honorary Fellow of the Royal College of Surgeons of England. No one more justly deserved that honour than that modest man, Dr. Norman Shenstone, who has done so much pioneer work in the surgery of the chest, and his many friends were delighted that he should be so honoured by the Royal College of England.

On the occasion of Sir Gordon's visit to Toronto he stated that during his travels throughout the Commonwealth, it gave him a great deal of pleasure to have one of his former house surgeons perform an operation in his presence. Following this request I arranged to perform a lumbar sympathectomy at the Hospital for Sick Children, on a little child, a victim of infantile paralysis with some shortening of the leg associated with coldness of the extremity on the affected side. Fortunately this operation went very well, and as is usual under the circumstances, it appeared to be a very simple surgical procedure. I apologized to G.T. for not being able to perform an operation that might be of greater interest to him. As was so characteristic of the man who always tried to encourage his younger colleagues, his reply was — "But, my dear fellow, I am interested in all branches of surgery. The operation was performed by you in a superb manner," and then he proceeded to tell me about the unfortunate experience of another surgeon whom he had watched doing a similar operation.

During the second World War, Sir Gordon, though then a man well past 60 years of age, again came to the service of his country, and after being turned down by the R.A.M.C. becaue of his age, was very soon accepted in the senior service, serving as Surgeon Rear-Admiral in the Royal Navy throughout the remainder of the war. While serving with the Royal Navy he travelled extensively throughout Great Britain and made many trips to the United States, Canada, and to other countries of the Commonwealth. In 1943 he travelled to Russia for the British Council, and during that visit, on behalf of the Royal College of Surgeons of England, he conferred the Honorary Fellowship of the College on the famous Russian surgeons, Judin and Burdenko. In recognition of his distinguished services during World War II, he was rewarded by his sovereign, the late King George VI, by being made a Companion of the Most Honourable Order of the Bath and receiving a Knighthood in the Most Excellent Order of the British Empire. He was also named a Commander of the United States Legion of Merit.

Following the war, Sir Gordon continued to hold an active interest in surgery, devoting most of his time to consulting practice and writing. He was appointed Official Adviser to Overseas Students from the Commonwealth by the Royal College of Surgeons. In that capacity he spent several hours, two mornings each week, at the home of the Royal College on Lincoln's Inn Fields Road. There he would meet postgraduate students from all parts of the Commonwealth, discuss with them their plans for further training, and greatly assist them in obtaining suitable appointments for such training, in all parts of Great Britain. Frequently following these interviews he would invite them to have lunch with him at the Ritz Hotel on Piccadilly, where, in the dining-room, his favourite table, overlooking Green Park, would be waiting for him. Many of the staff of the Ritz, and even their fathers before them, had been former patients of Sir Gordon. He always received the loving

attention and devoted service which he so justly deserved.

As a result of his extensive travels throughout the Commonwealth and his meeting with so many young men and women at the Royal College, he became by far the best known and most highly regarded British surgeon of all time throughout the British Commonwealth. He followed with keen interest the progress of his younger colleagues, and he appeared to be as pleased with their attainments as would be a father with his son.

Sir Gordon had a remarkable memory for names, and his numerous friends and colleagues throughout the Commonwealth were always remembered with a card from him at Christmas. These cards were always addressed in his own hand, together with a suitable personal note, and were ready for mailing about August. I believe it was his custom to send about 1000 Christmas cards each year. Some 800 cards were already addressed and ready for mailing before G.T.'s death last year. It was with a feeling of sadness that one received his card some time after his death, sent by his faithful secretary, Miss Johnson.

Sir Gordon gave many lectures and addresses on surgery and other subjects throughout Great Britain, the various countries of the Commonwealth, the United States and many other countries. These were all most carefully prepared, written and rewritten until they had reached the perfection in composition and language that he would accept, and then so carefully memorized that they were delivered by him without a note.

Sir Gordon was the recipient of numerous honours from various centres of learning in Great Britain, the various countries of the Commonwealth, the United States and other nations. These have already been recorded elsewhere and I will not, at this time, make any attempt to review the lengthy list of brilliant addresses and the honours bestowed upon him.

Sir Gordon was devoted to his mother, a Gordon, and a member of that famous Scottish clan who played such a prominent part in the early history of Scotland and who later distinguished themselves in the service of Great Britain and the Commonwealth over a period of more than 200 years. G.T. was proud to be a member of the Gordon clan, as one can assume from the name he chose. He was a brilliant example of the true Scot, generous, kindly and possessing an unusual capacity for making friends and giving something of himself to them.

Sir Gordon's interest in cricket started when he was a boy at school and he retained a keen interest in the game throughout his life. He was a member of Lord's Cricket Ground, and especially during his latter years he frequently would be found at Lord's watching a test match. It was while crossing the road near the entrance to Lord's Cricket Ground that he was struck by a motor car, sustaining serious injuries which led to his death a few hours later, on September 3, 1960, in his 83rd year.

With the death of Sir Gordon Gordon-Taylor the world of medicine lost its greatest classical scholar and most distinguished surgeon, and the British Commonwealth of Nations lost their greatest ambassador of good will. We, his former students and house surgeons throughout the Commonwealth, have lost an old friend whom we loved and admired, and who will remain always a guiding light in our lives.

Our sympathy goes out to his only living sister, and to Miss Johnson, his devoted and faithful secretary for so many years.

Résumé

Sir Gordon Gordon-Taylor est né à Aberdeen, en Ecosse, en 1878. Il fit ses études au Gordon's College puis à l'Université d'Aberdeen, où il obtint avec distinction son diplôme de M.A.

Alors qu'il était encore jeune homme, son père mourut et, de ce fait toute sa famille dut se déplacer et habiter Londres. Il s'inscrivit comme étudiant en médecine au "Middlesex Hospital". Cette institution lui décerna en 1903 le grade de bachelier en médecine. Durant ces études il montra un interêt tout particulier pour l'anatomie et ayant gagné une médaille pour ses connaissances dans cette discipline, il décida d'approfondir cette science et commença son baccalauréat es sciences. Il obtint en 1906 son M.S., et en même temps devint "Fellow" du Collège Royal de Chirurgie d'Angleterre.

Il fut nommé membre du bureau médical de l'Hôpital du Middlesex dans le service de Sir John Bland-Sutton en 1908. En 1921, il succéda à Sir John comme directeur du service et peu après devint Chirurgien-Chef de l'Hôpital.

Pendant la première guerre mondiale, il servit dans le corps expéditionnaire britannique comme chirurgien. Il contribua grandement au progrès de la chirurgie de guerre, opérant souvent dans les ambulances avancées, sauvant les vies de nombreux soldats; sans aucun doute, l'un de ses plus grands mérites fut l'amélioration du traitement des blessures de l'abdomen par balles. Il eut l'occasion de faire la connaissance de Bruce Robertson, un chirurgien canadien grandement intéressé dans les questions de transfusion sanguine: Sir Gordon coopéra avec lui et adopta ses idées: de sorte que, contrairement à ce que l'on croit généralement, ce sont ces deux hommes qui ont répandu l'usage de la transfusion d'urgence.

A la fin de la guerre, Sir Gordon fut nommé Major et reçut la médaille de l'Ordre de l'Empire Britannique.

Il reprit alors son poste de Chirurgien-Chef de l'Hôpital du Middlesex. Il réorganisa l'enseignement des internes et des résidents, en s'attachant surtout à la pratique. Les séances opératoires étaient le lundi et le vendredi dans l'après-midi.

Sir Gordon entretenait des relations scientifiques très étroites avec Sir Berkeley Moynihan qui devint plus tard Lord Moynihan, pour lequel il avait une très grande admiration.

En 1939, Sir Gordon fit un voyage au Canada et y donna une série de conférences.

Lorsque la deuxième guerre mondiale éclata, bien qu'il eut atteint la soixantaine, Sir Gordon tint à rejoindre l'armée; il occupa l'emploi de Vice-Amiral Chirurgien dans la marine: ce fut pour lui l'occasion de nombreux voyages à travers l'Angleterre, le Canada, les Etats-Unis et les pays du "Commonwealth". Sa Majesté le Roi Georges VI le fit Compagnon de l'Ordre du Bain et Chevalier de l'Ordre de l'Empire Britannique. Il fut aussi nommé Commandeur de la Légion du Mérite des Etats-Unis.

Il consacra la fin de sa vie à l'enseignement, à la lecture et à la publication de divers ouvrages. Il mourut, d'accident, à l'âge de 83 ans.

Le monde médical a perdu un de ses plus grands chirurgiens, et l'un des plus distingués.

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Manuscripts of original articles, case reports, and other contributions should be forwarded with a covering letter requesting consideration for publication in the *Canadian Journal of Surgery*. Acceptance is subject to the understanding that they are submitted solely to this Journal, and will not be reprinted without the consent of the author and the publishers. Acceptance or rejection of contributions will be determined by the Editorial Board. As space is available, a limited number of case reports will be published. Articles should be typed on one side only of unruled paper, double-spaced, and with wide margins. Carbon copies cannot be accepted. The author should always retain a carbon copy of material submitted. Every article should contain a summary of the contents. The Concise Oxford Dictionary will be followed for spelling. Dorland's American Medical Dictionary will be followed for scientific terminology. The Editorial Board reserves the right to make the usual editorial changes in manuscripts, including such changes as are necessary to ensure correctness of grammar and spelling, clarification of obscurities or conformity with the style of the *Canadian Journal of Surgery*. In no case will major changes be made without prior consultation with the author. Authors will receive galley proofs of articles before publication, and are asked to confine alterations of such proofs to a minimum.

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Reprints may be ordered on a form which will be supplied with galley proofs. It is important to order these before publication of the article, otherwise an extra charge for additional type-setting will be made.

References

References should be referred to by numerals in the text and should be set out in accordance with the *Cumulative Index Medicus* abbreviation of journal name and general style. They should include in order: the author's name and initials in capitals; title of the article; abbreviated journal name; volume number, page number and year. References to books should include in order: author's name; title of book; title of publishing house; city of publication; number of edition (e.g., 2nd ed.); year of publication.

Illustrations

A reasonable number of black-and-white illustrations will be reproduced free with the articles. Colour work can be published only at the author's expense. Photographs should be glossy prints, unmounted and untrimmed, preferably not larger than 10″ x 8″. Prints of radiographs are required and *not the originals*. The magnification of photomicrographs must always be given. Photographs must not be written on or typed on. An identifying legend may be attached to the back. Patients must not be recognizable in illustrations, unless the written consent of the subject for publication has been obtained. Graphs and diagrams should be drawn in India ink on suitable white paper. Lettering should be sufficiently large that after reduction to fit the size of the Journal page it can still be read. Legends to all illustrations should be typed separately from the text and submitted on a separate sheet of paper. Illustrations should not be rolled or folded.

Language

It should be clearly understood that contributors are at full liberty to submit articles in either English or French, as they please. Acceptance will be quite independent of the language of submission. If the contributor wishes, he may submit an informative summary of not more than 300 words in the language other than that in which he has submitted the article. For example, an article in English must carry an English summary and may, if the author wishes, carry a more detailed summary in French.

The Royal College of Physicians and Surgeons of Canada

NEWSLETTER

Two events of interest to Fellows of the Royal College took place at the Annual Meeting in Ottawa in January of this year. The first evening of the meeting saw the new headquarters building officially opened by the Prime Minister of Canada, the Right Honourable John Diefenbaker, in a colourful ceremony. This was witnessed by a large group of attending Fellows and their wives, through the medium of closed circuit television.

At Convocation held on the second evening of the meeting, an honorary Fellowship was conferred on Major-General Georges Vanier, Governor-General of Canada. At the same time an Honorary Fellowship was given to Sir Walter Mercer, emeritus professor of Orthopedic Surgery of the University of Edinburgh for his outstanding work as a teacher in his field. An Honorary Fellowship was also granted *in absentia* to Mr. Samuel McLaughlin for his generous contributions to the cause of medicine in Canada.

Registration at the Royal College Regional Meeting held in London, Ontario, in November 1960 exceeded 300 and the meeting proved to be a great success; again auguring well for the future. At present, plans are being worked out for a Western Regional meeting in Saskatchewan next Fall.

It was announced recently that the Sims Commonwealth Travelling Professor to Canada for 1961 will be the outstanding and well known cardiologist, Dr. Paul Wood, Physician to the National Heart Hospital, London, England.

The McLaughlin-Gallie Travelling Professor for 1961 is to be Sir George Pickering, Regius Professor of Medicine at the University of Oxford. Both Professors will visit Canada in the Fall of this year. Details of their itineraries in Canada will be announced later.

The results of this year's Fellowship examinations have been announced in detail previously. The overall percentage of successful candidates in surgery and the surgical specialties for this year was 32.8% as compared with 40% for 1959. This may be compared with the results in Certification for 1960 of 58% and 1959 of 60%.

At the recent meeting of Council specific recommendations from the Credentials Committee were discussed concerning the establishment of a Fellowship examination modified for Cardiovascular and Respiratory Surgery, this to replace the present Certification examination in Thoracic Surgery. Further details concerning the Regulations and Requirements of graduate training relating to this examination will be forthcoming in the future.

Recently adopted statements of Council policy on dichotomy and on itinerant surgery will be found elsewhere in this issue of the *Canadian Journal of Surgery*.

W. Gordon Beattie, F.R.C.S.[C],
Honorary Assistant Secretary
February 27, 1961.

RESOLUTION AND STATEMENT PASSED BY THE COUNCIL AT A MEETING IN OTTAWA

January 17, 1961

WHEREAS this Council of The Royal College of Physicians and Surgeons of Canada has considered the problem of ITINERANT SURGERY, that is, surgery performed on a patient unfamiliar to the surgeon at a distance from his practice and where the diagnosis, pre and postoperative care is delegated to another physician, and whereas this Council of The Royal College of Physicians and Surgeons of Canada recognizes that the operative procedure is only a portion of the surgical care of the patient,

BE IT RESOLVED that this Council of The Royal College of Physicians and Surgeons of Canada condemns ITINERANT SURGERY *as defined above* as

being detrimental to the best interests of the patient and contradictory to the present concepts of comprehensive surgical care.

When the circumstances are such that it is in the best interest of a patient's care to have an operative procedure carried out by a surgeon in a hospital remote from the site of his regular practice, that surgeon must be responsible for the diagnosis, the pre and postoperative care of the patient.

The surgeon's fee for these services must be commensurate with the services rendered and for the time that he has been away from his regular place of practice.

In view of the foregoing it becomes evident that any attempt on the part of practitioners or prepaid medical plans to divide the regular surgical fee between the participating surgeon and the practitioner in this situation is not ethical or in the best interests of the patient.

AN INFORMATORY STATEMENT REGARDING THE POSITION THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS OF CANADA TAKES TOWARD DICHOTOMY OF FEES, AND THE PRINCIPLES OF FINANCIAL RELATIONS IN THE PROFESSIONAL CARE OF THE PATIENT

(Reference may also be made to the Code of Ethics as set up in Article 12 of the By-Laws of the Royal College of Physicians and Surgeons of Canada)

1. IN HIS RELATIONSHIP WITH THE PATIENT, a Fellow of The Royal College of Physicians and Surgeons of Canada or a Certificant of the College should inform the patient, or a member of his family, of the identities of the doctors who will collaborate in the care of the patient; should be willing to discuss his fee with the patient or a member of the patient's family, prior to submitting a statement; and should present a statement for his own services to the patient.

(a) INFORM THE PATIENT, OR A MEMBER OF HIS FAMILY, OF THE IDENTITIES OF THE DOCTORS WHO WILL COLLABORATE IN THE CARE OF THE PATIENT.

Once a patient is referred for care and treatment, the surgeon is morally and legally responsible for his own preoperative diagnosis; for the decision to operate; for such preoperative care as has not been given; for the performance of the operation, and postoperative care as long as necessary. These responsibilities do not preclude consultation with colleagues. The patient should be referred back to his physician when he no longer requires surgical care.

The concept of surgical care as a team effort is important. The patient should be informed that he may be cared for by several individuals working under the direction of the responsible surgeon.

(b) SHOULD BE WILLING TO DISCUSS HIS FEE WITH THE PATIENT, OR A MEMBER OF THE FAMILY, PRIOR TO SUBMITTING A STATEMENT.

Discussion prior to submitting a statement may prevent misunderstanding and the resentment of patients about the surgeon's fee. Satisfactory agreement can usually be reached by a frank discussion of all considerations involved in the determination of a fee.

The fee of Fellows or Certificants should be commensurate with the services rendered and the reasonable ability of the patient to pay.

An exorbitant fee is one which exceeds either the value of the services rendered, or the reasonable ability of the patient to pay.

The value of the services performed depends upon the type of operation, the extent of the surgery and the special surgical skill required.

The surgeon should charge only for those services rendered personally by him or, under his direction, by his employees or surgical associates.

The referring physician, or consultant, should submit his individual bill for the services which he renders.

Reasonable ability to pay is the ability of the responsibile individual to pay without endangering the economic stability of the family.

To determine reasonable ability to pay, all expenses incident to the care of the patient should be considered. The economic level of the family should govern, regardless of the existence of insurance against the costs of medical care, except that an insurance benefit may be regarded as ability to pay that amount. Medical care insurance is not designed to serve as a platform upon which to erect an additional fee not justified by the economic level of the family.

When two doctors are to submit individual bills, and it becomes apparent that the total charges to the patient will exceed his reasonable ability to pay, it is proper that they confer and adjust their fees downward.

(c) PRESENT A STATEMENT FOR HIS OWN SERVICES TO THE PATIENT.

Payment should be made individually to each doctor regardless of whether separate bills or a combined itemized bill are presented. This principle applies with equal force to payment by a third party.

Ethically, a Fellow or a Certificant, may not pay the referring physician for any services the latter performs in the care

of the patients, nor may a Fellow or a Certificant resort to a subterfuge to assist the referring physician to collect an unjustifiable fee, such as permitting the latter to render unnecessary services.

2. IN HIS RELATIONSHIP WITH PROFESSIONAL COLLEAGUES, a Fellow of The Royal College of Physicians and Surgeons of Canada, or a Certificant of the College should refuse to participate in, or countenance, any financial arrangement which would induce referral of a patient; refuse to permit a referring physician to collect his fee for him; refuse to collect the fees of other doctors collaborating in the care of the patient.

(a) REFUSE TO PARTICIPATE IN, OR COUNTENANCE, ANY FINANCIAL ARRANGEMENT WHICH WOULD INDUCE REFERRAL OF A PATIENT.

The responsibility of a physician to his patient requires that he place the interests of his patient above every other consideration. It should be understood that, in the referral of a patient for surgical care, the physician be guided only by the quality of care expected of the surgeon. Acceptance of any other inducement is a violation of the trust placed in him by the patient.

The patient must be protected from various forms of subterfuge which contribute to unethical inducement:

1. Division of the surgical fee between surgeon and referring physician. Division of a fee paid by an insurance carrier is as much fee-splitting as division of a direct payment by the patient.
2. Permitting the referring physician to collect the total bill from the patient and pay the surgeon.
3. Alternate billing of surgical patients, wherein the surgeon and referring physician collect and retain the entire fee from alternate patients.
4. Disproportionate reduction of the surgeon's fee to enable the referring physician to charge excessively for his services.
5. Payment of office rent on a percentage of professional income, particularly when the owners or lessees of the space can refer patients to the surgeon.
6. Lavish entertainment of referring physicians.

Acceptance of a rebate from a manufacturer or dealer, who has supplied a patient with a drug, appliance or other adjunct to treatment, is unethical. It is unethical for an ophthalmologist, or for an ophthalmic surgeon, to profit from the sale of glasses, or to profit from the services of an optician working either in his office or upon a referral basis.

It is also unethical for a Fellow or Certificant to accept a rebate from a clinical pathology laboratory, or a roentgenologist.

(b) REFUSAL TO PERMIT A REFERRING PHYSICIAN TO COLLECT THE SURGEON'S FEE FOR HIM.

The surgeon is not a subcontractor in the surgical care of the patient. Unless the surgeon presents his own bill to the patient, the latter has no way of knowing the amount of the surgeon's fee. Payment of the surgeon by the referring physician may invite fee-splitting and may result in an excessive bill to the patient.

(c) REFUSE TO COLLECT THE FEES OF OTHER PHYSICIANS COLLABORATING IN THE CARE OF THE PATIENT.

The patient is entitled to know how much he has been charged by each doctor with whom he has a contractual relationship. This can be assured only by each physician sending and collecting his own bill.

A surgical assistant, other than the referring physician, who stands in no other professional relationship with the patient, is an employee of the surgeon and can be paid an assistant's fee by the surgeon if this amount is indicated on the account sent to the patient.

In the submission of statements to patients, clinic groups and formal partnerships are regarded as single contractors, and may submit one bill for all services rendered by individual members. Accounts should be itemized so the patient will know the doctor rendering the service.

FORTHCOMING MEETINGS

UNIVERSITY OF TORONTO POSTGRADUATE COURSE IN OTO-LARYNGOLOGY

A graduate course in oto-laryngology will be presented by the Staff of the Department of Oto-laryngology on May 11, 12 and 13, 1961. They will be assisted by two distinguished guests, Dr. Philip E. Meltzer, Professor of Oto-laryngology, Harvard Medical School, and Chief of Oto-laryngology, Massachusetts Eye and Ear Infirmary, and Dr. W. G. Hemenway, Department of Oto-laryngology, University of Chicago.

The first session will begin in the afternoon of May 11, in the Royal York Hotel, Toronto, in association with the Section of Oto-laryngology of the Ontario Medical Association. The remainder of the sessions will be held in the clinical areas of the University of Toronto.

An attempt will be made to assess, discuss, and demonstrate the newer procedures employed in the surgery of deafness. The present surgical treatment of head and neck problems

will be presented with special consideration of the new conceptions of responsibilities of this specialty in their management.

The fee for the course will be $40, and will include a complimentary dinner.

All enquiries should be addressed to the Director, Division of Postgraduate Medical Education, University of Toronto.

AMERICAN COLLEGE OF SURGEONS: FIFTH POSTGRADUATE COURSE ON FRACTURES AND OTHER TRAUMA

The Fifth Postgraduate Course on Fractures and Other Trauma, sponsored by the Chicago Committee on Trauma of the American College of Surgeons, will be held from April 19-22, 1961, at the John B. Murphy Memorial Auditorium, 50 East Erie Street, Chicago.

The course for 1961 is dedicated to Dr. Edwin Ryerson, an eminent orthopedic surgeon who was a leader in his field and for many years was actively associated with the Chicago Committee on Trauma of the American College of Surgeons.

The course will be presented by a distinguished faculty of 11 guest speakers and teachers prominent in the fields of trauma, from the five medical schools, and chiefs of services from leading Chicago hospitals who will discuss all phases of trauma; injuries to the head, face, chest, abdomen; genitourinary tract; plastic procedures on the extremities; skeletal traction versus adhesive traction; shock; the current prevention and treatment of gas gangrene; blood vessel injuries; major tendon disruptions; acute tendon injuries of the hand and forearm; ligamentous injuries to the knee; modern amputation techniques, and a new treatment for suppurative conditions secondary to trauma of the skeleton.

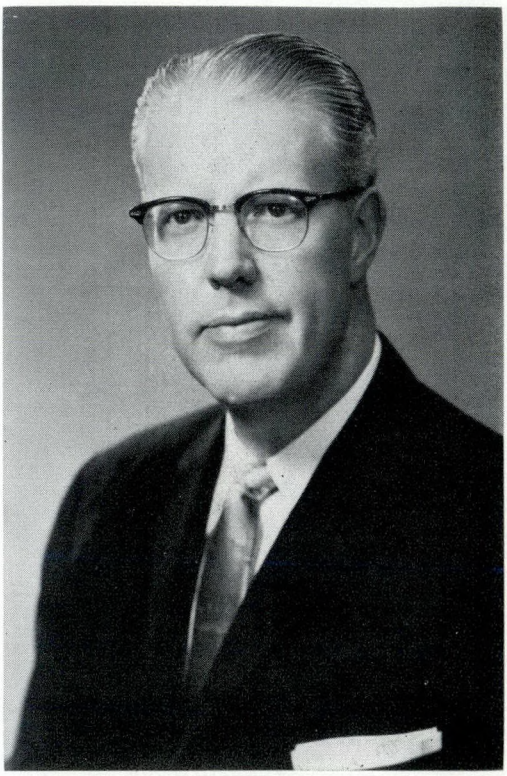
There will be panel discussions on athletic injuries, and fractures and dislocations of the tarsal bones. Many types of fractures and dislocations will be discussed. In addition, audio-visual programs, consultative periods, panel discussions, question-and-answer periods and eight presentations concerning various types of trauma will also form a prominent part of the program.

Distinguished visiting speakers will be Drs. William H. Bickel, Rochester, Minn.; Bruce J. Brewer, Milwaukee; James Barrett Brown, St. Louis; Edwin F. Cave, Boston; C. Howard Hatcher, Palo Alto; Charles C. Higgins, Cleveland; J. William Littler, New York; Owen E. Miller, Milwaukee; Austin T. Moore, Columbia, S.C.; Don H. O'Donoghue, Oklahoma City; and Robert A. Robinson, Baltimore.

The individual notices to physicians, which will be mailed well in advance of the meeting, will list suitable hotels in close proximity to the John B. Murphy Memorial Auditorium. The registration fee will be $75.00.

Dr. Sam W. Banks, Chairman of the Chicago Committee on Trauma, is Director of the course. Inquiries should be addressed to Dr. John J. Fahey, who is Chairman of the Committee on the Postgraduate Course on Fractures and Other Trauma, at 1791 W. Howard Street, Chicago 26, Illinois, U.S.A.

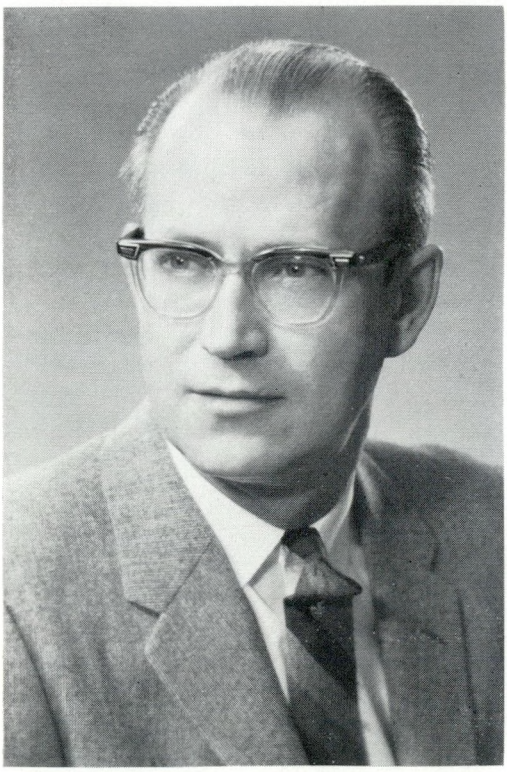
NOTICES



DR. WALTER C. MACKENZIE

With great regret we announce the resignation of Dr. Walter C. MacKenzie from the Editorial Board of the *Canadian Journal of Surgery*. Since the first number of the journal was published in October 1957, Dr. MacKenzie has contributed unstintingly of his efforts and his wisdom, a contribution that has been in no small way responsible for such success as the board

has achieved in the discharge of its functions. Dr. MacKenzie's ever-increasing duties and responsibilities as Dean of the Faculty of Medicine of the University of Alberta, required that he relinquish his post as Professor and Head of the Department of Surgery in 1960 and his resignation from the Editorial Board of the journal followed in consequence. The board records its sincere gratitude to Dr. MacKenzie for his contributions of the past and will sorely miss the benefit of his experience and sound judgment.



DR. ROBERT A. L. MACBETH

Succeeding Dean MacKenzie as Professor and Head of the Department of Surgery at the University of Alberta, and as that university's representative on the Editorial Board of the *Canadian Journal of Surgery* is Dr. Robert A. L. Macbeth of Edmonton. With the anticipation of a long and mutually gratifying association, the board welcomes Dr. Macbeth to membership in its ranks.

1961 MEDALLIST—THE ROYAL COLLEGE OF SURGEONS OF CANADA.

Royal Studio, Toronto

DR. JOHN STATON SPEAKMAN

The Annual Award in Surgery of the Royal College of Physicians and Surgeons of Canada was this year presented to Dr. John S. Speakman of Toronto in recognition of his studies on the structure of the trabecular meshwork and corneal endothelium in relation to the problem of resistance to outflow in open angle glaucoma. Dr. Speakman's investigations on this project were conducted in the Department of Ophthalmology of the University of Toronto and the Department of Pathology, Institute of Ophthalmology, London, England.

Books Received

Books are acknowledged as received, but in some cases reviews will also be made in later issues.

Calcium Metabolism and the Bone. Paul Fourman, M.D., D.Sc., F.R.C.P. Senior Lecturer in Medicine, Welsh National School of Medicine. 325 pp. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $10.25.

Clinical Orthopædics. Editor-in-Chief, Anthony F. DePalma, with the Assistance of the Associate

Editors, the Board of Advisory Editors, the Board of Corresponding Editors. No. 17. 387 pp. Illust. J. B. Lippincott Company, Philadelphia and Montreal, 1960. $6.00 to sustaining members, $7.50 per individual copy.

Clinical Orthopædics Editor-in-Chief Anthony DePalma, with the Assistance of the Associate Editors, the Board of Advisory Editors, the Board of Corresponding Editors. No. 18. 293 pp. Illust. J. B. Lippincott Company, Philadelphia and Montreal, 1960. $6.00 to sustaining members, $7.50 per individual copy.

Congenital Deformities. Gavin C. Gordon, M.B., F.R.C.S.E. Consultant Orthopædic Surgeon, Cumberland and North Westmorland; Orthopædic Surgeon and Adviser in Physical Medicine, Irton Hall School (N.S.S.), Cumberland, England. 128 pp. Illust. E. & S. Livingstone Ltd., Edinburgh and London; The Macmillan Company of Canada Limited, Toronto, 1961. $6.35.

Klinische Chirurgie für die Praxis. In vier Banden. Band 1, Lieferung 4. (Clinical Practice of Surgery. In 4 volumes. Vol. 1, Part 4). Edited by O. Diebold, H. Junghanns and L. Zukschwerdt. 366 pp. Illust. Georg Thieme Verlag, Stuttgart, W. Germany. Intercontinental Medical Book Corporation, New York, 1960. $12.85.

Modern Trends in Urology (Second Series). Edited by Sir Eric Riches, Past President British Association of Urological Surgeons (Home and Overseas), Surgeon and Urologist the Middlesex Hospital, London. 27 contributors. 287 pp. Illust. Butterworth & Co. Ltd., London, 1960. $14.00.

Nouvelle Pratique Chirurgicale Illustrée. Fascicule XVI. Directeur Jean Quénu. (New Surgical Practice Illustrated. Edited by Jean Quénu). 296 pp. Illust. G. Doin et Cie, Paris, 1960. 41NF.

Surgery of the Acute Abdomen. John A. Shepherd, *V.R.D.*, M.D., Ch.M.(St. And.), F.R.C.S.(Ed.), F.R.C.S.(Eng.), *Q.H.S.* Consultant General Surgeon, Liverpool Region. Formerly Lecturer in Surgery, University of Liverpool. Surgeon Captain R.N.R. Foreword by Sir Zachary Cope, M.D., M.S., F.R.C.S. 1228 pp. Illust. E. & S. Livingstone Ltd., Edinburgh and London; The Macmillan Company of Canada Limited, 1960. $17.00.

The Surgical Treatment of Portal Hypertension, Bleeding Esophageal Varices and Ascites. M. Judson Mackby, M.D., D.A.B.S., F.I.C.S. Staff Surgeon, Kaiser Foundation Hospital, San Francisco, California, and Staff Surgeon, Permanent Medical Group. Foreword by Emile Holman, M.D., Professor Emeritus of Surgery, Stanford University Medical School. American Lecture Series No. 388. 250 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $11.50.

Transactions of the International Society of Plastic Surgeons. Second Congress, London, 1959. Edited by A. B. Wallace, M.Sc., F.R.C.S.(Ed.) Translations of abstracts into French by Michael N. Tempest, Ch.M., F.R.C.S.(Ed.), German by W. Grossman, M.D., and Spanish by R. P. G. Sandon, F.R.C.S. E. & S. Livingstone Ltd., Edinburgh and London; The Macmillan Company of Canada Limited, Toronto. 1960. $15.25.

The Urological Aspects of Bilhariasis in Rhodesia. R. M. Honey, M.B., F.R.C.S.(Ed.), Consulting Urologist, Salisbury Hospitals Group, and M. Gelfand, C.B.E., M.D., F.R.C.P., Consulting Physician, European and African Hospitals, Salisbury, Rhodesia. Foreword by D. M. Blair, O.B.E., M.D., D.P.H., Secretary for Health, Federation of Rhodesia and Nyasaland. 71 pp. Illust. E. & S. Livingstone Ltd., Edinburgh and London; The Macmillan Company of Canada Limited, Toronto, 1960. $1.30.

BOOK REVIEWS

(See also pages 276, 292, 320, 323, 337 and 382)

HYPOTHERMIA FOR THE NEUROSURGICAL PATIENT. Antonio Boba, M.D., Associate Professor of Anesthesiology, the Albany Medical College of Union University, Albany, N.Y. 124 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $6.50.

This concise, well written monograph should be of particular value to neurosurgeons and anesthetists.

The general physiological responses to hypothermia are described and illustrated with great clarity and authority. All important references are included.

Various methods of achieving hypothermia are briefly outlined. Mechanisms of heat transfer and temperature gradients which result from the various methods are well described and illustrated. The detection and management of the problem of "shivering" is well handled. The effect of hypothermia upon the central nervous system is well covered including problems of volume, pressure and ability to withstand injury.

The various parameters which the anesthetist must observe and manage in clinical hypothermia, are well described.

The hazards and complications are frankly outlined.

This book should be of great interest to all who have any concern with experimental or clinical hypothermia.

LES ENTRETIENS DE BICHAT 1960. Chirurgie-spécialités. (Colloquium of Bichat, Surgery and Specialities, 1960). Edited by R. Gueulette, J. Hepp, Y.-J. Longuet and M. Roux, chirurgiers de l'Hôpital Bichat. 557 pp. Expansion Scientifique Française, 1960.

Ce volume est un recueil de nombreux articles par des auteurs différents, couvrant plusieurs sujets de chirurgie générale et des spécialités chirurgicales. Bien qu'il soit impossible de donner une opinion d'ensemble sur un tel ouvrage, on peut affirmer que la plupart des travaux résument de façon concise un problème donné.

L'ouvrage comprend deux parties: chirurgie générale et spécialités. Mais, on peut reprocher aux éditeurs de n'avoir pas groupé à l'intérieur de cette division les articles concernant un même sujet. Une table analytique, à la fin de l'ouvrage, corrige en partie cette lacune.

En chirurgie vasculaire, deux articles traitent des pontages artériels. Mentha démontre l'utilité de la prise de la tension artérielle per-opératoire dans les différents segments des artères intéressées; tandis que Natali insiste sur le genre d'activité du malade quand il pose les indications d'une prothèse artérielle. Léger et Mouktar ont publié un bon résumé de la question de l'anévrysme de l'artère splénique. D'autres articles traitent de l'hypertension portale, des complications thrombo-emboliques et du syndrome post-phlébitique.

Plusieurs problèmes sont discutés en chirurgie de l'appareil digestif tels que les adénites mésentériques, l'ulcus duodénal, la lithiase cholédocienne, le syndrome de Zollinger Ellison . . . Bernard Duhamel présente les possibilités de sa technique consistant en une exclusion du rectum avec abaissement rétro-rectal et trans-anal du côlon.

En conclusion, l'ouvrage est une collection de travaux d'un groupe imposant de chirurgiens et une aide à qui veut les solutions de ces auteurs aux problèmes qui y sont traités.

CHEMICAL OSTEOSYNTHESIS IN ORTHOPÆDIC SURGERY. Michael P. Mandarino, M.D., Associate, Department of Orthopædic Surgery, Hahnemann Medical College and Hospital. 72 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $5.00.

In this small book the author presents an enthusiastic brief for the use of bone glue. The glue under discussion is a polyurethane foam used under the W. S. Merrell & Company trade name of Ostamer. This substance has the necessary properties. It is strong, non-toxic, adheres to bone, expands out into irregular spaces, provides a lattice into which bone many grow and is relatively easy to use.

The author outlines rather extensive indications for the use of Ostamer. The prime use seems to be in non-union of bone in which previous operative measures have failed. Other indications considered are pathological fractures, bone cysts, acute fracture prone to complications, spinal fusions and other joint fusions. The technique of the use of Ostamer is simple. A dry field is necessary to allow strong bonding of glue to bone. With this in mind, one wonders how good fixation can be achieved in spinal fusions. If the medullary canal of the long bone is small, the author has used intramedullary rods for additional support. Emphasis is placed on the use of a large mass of Ostamer.

To support his claim for Ostamer, the author outlines his experience with 50 personally treated patients. The results are impressive. Many patients had non-union of long bone fractures previously treated unsuccessfully by operation. The first tibial fracture in this series was operated upon in 1956. All patients were allowed early ambulation. Of the 50 cases, all but three had successful results. It is pointed out that even in the presence of infection Ostamer may be used. It is apparent that the author is an enthusiast, and his own recorded results with the use of Ostamer are very impressive.

With general use it is likely that bone glue will find an important but more restricted use in the treatment of difficult non-unions and pathological fractures of long bones.

NOUVELLE PRATIQUE CHIRURGICALE ILLUSTREE. Fascicule XV (New Surgical Practice, Illustrated, Fascicle XV). Edited by Jean Quénu. 286 pp. Illust. G. Doin et Cie, Paris, 1960. 39NF.

Cet ouvrage est un classique et est très connu des chirurgiens de langue française. Il se compose de plusieurs fascicules, chacun décrivant sous forme d'atlas quelques techniques opératoires. A certaines occasions, l'histoire d'un cas et quelques commentaires sur le traitement de la maladie sont notés.

Le fascicule XV décrit l'ablation d'un neurinome intrathoracique, la myoplastie pour incontinence anale, la kysto-jéjunostomie pour pseudo-kyste du pancréas, la myomectomie abdominale, la côlo-cystoplastie et finalement l'aponévrectomie palmaire.

A propos de la myoplastie à l'aide du muscle droit interne pour corriger une incontinence anale, Dubost note que les résultats se détériorent avec le temps et qu'il ne faut pas se fier à des statistiques faisant état de succès trop précoces.

De plus, Perrotin conseille la dérivation interne par kysto-jéjunostomie en Y quand le pseudo-kyste du pancréas n'est pas réséquable.

En résumé, ces manuels de technique chirurgicale sont bien faits en ce qui concerne la description des différents temps opératoires. Cependant, on peut reprocher aux éditeurs de n'avoir pas groupé les différentes techniques selon les régions anatomiques, mais de les avoir disposées, semble-t-il, au hasard.

MEMORY, LEARNING AND LANGUAGE. The Physical Basis of Mind. Edited by William Feindel. University of Saskatchewan Jubilee Symposium, 1959. 69 pp. Illust. University of Toronto Press, 1960. $2.00.

This book consists of six essays comprising a symposium that was designed to acquaint intelligent laymen with some views of the function of the brain that have an important bearing on the processes of education. Sur-

geons with an enquiring mind, who are interested in the greater potentialities of the human brain, and whose normal reading does not include recent neurological literature, should find this small book of interest and a stimulus for further enquiry. The essays were given originally in 1959 as lectures at the 50th anniversary celebration of the University of Saskatchewan. The humanistic, anatomical, chemical, cybernetic, mechanical, and physiological viewpoints of mental activity are each outlined in turn. The heritage from Ancient Greece and Rome in our modern concept of memory is discussed by Dr. J. F. Leddy. Dr. William Feindel, the editor, sketches the microscopic anatomy of the cerebrum, the significance of electroencephalography and some mechanistic views of cerebral activity. Dr. A. Hoffer contributes a short discussion of the strange effects on mental activity of hallucinogenic drugs. He includes rather an uncritical reference to the place of these drugs in the treatment of alcoholics. Dr. J. W. T. Spinks, President of the University of Saskatchewan, describes self-regulating machines, with a fascinating example of a self-propelled machine which is directed on its course by a rotating Geiger tube and is designed to follow the perambulations of a burrowing worm that is tagged with radioactive cobalt. Dr. Arthur Porter describes the arithmetical and logical operations of automatic computers and control systems. In the concluding essay Dr. Wilder Penfield outlines the physiological process of learning to speak and his well-known arguments in favour of teaching multiple languages in early childhood.

THE TRANSPLANTATION OF TISSUES AND ORGANS. Michael F. A. Woodruff, M.D., M.S.(Melb.), F.R.C.S., F.R.C.S.E., F.R.A.C.S. Professor of Surgical Science in the University of Edinburgh. 777 pp. Illust. Charles C Thomas, Springfield, Ill.; The Ryerson Press, Toronto, 1960. $28.00.

A distinguished professor of surgical science has in this book produced a most comprehensive single volume covering the widest phases of the exciting field of tissue and organ transplantation. In a rapidly advancing field, encompassing basic and clinical science, Professor Woodruff has met the difficult problem of organization and classification of material effectively. He has resisted the temptation to fantasize in a realm where imagination and ingenuity have so frequently played a role.

There is little doubt that the next decade or two will bring transplantation into all fields of medicine and this text promises to become a classic. Of the 110 pages of references, many are timely and for the most part well chosen. Current concepts of basic principles and techniques are presented clearly enough for even the casual reader to understand. In keeping with easy readability, long words and sentences are rarely used, where short ones will suffice.

Terminology is defined early and the material flows smoothly thereafter. Homotransplant survival, homograft immunity, experimental procedures and heterotransplant experiences are lucidly presented. Specific information regarding techniques of obtaining homotransplant materials now in use (artery, cornea, bone and so on) is well presented. The chapters on transplant of hematopoietic tissue, endocrine tissues and kidney are outstanding.

The author chose wisely not to dwell on blood transfusion (certainly a tissue transplant) since "there are already numerous books on the subject", and one wonders whether the chapters relating to plastic surgery, reconstructions of the alimentary tract and ureterointestinal anastomoses are, though well done, in keeping with the spirit of the book.

This classic is heartily recommended for the library of those working with tissue transplantation but will deservedly enjoy vigorous general circulation from the medical library shelves.

DAS SYSTEM DES DUCTUS THORACICUS UND DIE ERKRANKUNGEN DER REGIONALEN GEFASSE. Eduard Alther, with a preface by Prof. Dr. R. Nissen, Basel, Switzerland. 200 pp. Illust. Benno Schwabe & Company, Basel and Stuttgart, W. Germany; Intercontinental Medical Book Corporation, New York, 1960. $9.00.

Studies of the lymphatics have been constantly bypassed in medical research projects in the past. It is therefore not surprising to notice that medical men are puzzled when confronted with problems involving this system.

The surgeon, noticing an accumulation of chylous fluid, frequently faces a situation for which he has no solution at hand. To fill this gap in medical knowledge, the author has undertaken the exploration of the thoracic duct system.

The importance of this work becomes apparent by the fact that this monograph has received the support of the Swiss National Fund for Scientific Research. As underlined by Professor Dr. Nissen of Basel in his preface to this book, the reasons for the accumulation of chylous fluid, apart from traumatic causes, remain in large part unsolved. Existing knowledge about the lymphatic system was mainly concerned with its relationship to the defense mechanisms of the body against infections.

Therefore, the author's explanations of the hitherto unknown connections between the normally functioning lymphatics and their pathological changes are of value. In order to facilitate this understanding, the author develops original ideas about the embryonal development of the lymphatic system.

(Continued on page 400)

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(Continued from page 398)

Of interest to the reader will be the numerous excellent histological illustrations incorporated in this book. By analyzing the changes brought about by disease in the lymphatic vessel-tissue relationships, Dr. Alther contributes to a more comprehensive understanding of the lymphatics and their functions.

From this point the author proceeds to describe the different forms of treatment necessitated by the interruption of the circulation of chlye. In addition, this book, published in the German language, cites detailed case histories with therapeutic measures to be taken in order to provide the reader with a comprehensive understanding of the lymphatics and the problems in this field which may be encountered in medical practice.

KLINISCHE CHIRURGIE FUR DIE PRAXIS. In vier Banden. Band I. Lieferung III. (Clinical Practice of Surgery. In four volumes. Vol. 1 Part III). Edited by O. Diebold, H. Junghanns and L. Zukschwerdt. 618 pp. Illust. Georg Thieme Verlag, Stuttgart, W. Germany; Intercontinental Medical Book Corporation, New York, 1960. $12.85.

This edition deals with the diseases and surgical treatment of blood vessels, lymphatics and endocrine glands. Surgery as taught to medical students in continental Europe consists mainly of a mixture of pathology and medicine with additional lectures on fractures.

This book, intended to prepare European students for their surgery examination and to help the general practitioner in the daily problems confronting him, keeps within those limitations. Surgical problems, once diagnosis is established, come within the province of the specialist. Therefore, text books on surgery published in Germany cannot be compared with Canadian editions. Their purposes are different.

Consequently one will find good coverage of descriptive pathology, laboratory techniques and differential diagnosis in the European works, as achieved by the authors of this book.

It is to be regretted that B. Löhr, author of the chapter on blood vessels, in his endeavour for perfection to establish diagnosis, loses himself in subdivisions and statistics. In order to demonstrate Raynaud's disease, for example, one colour picture would have done much more than the lengthy and confusing tabulation. On the other hand, practically no detailed treatment is given for varicose veins. Their surgical treatment is mentioned, and the reader is directed to look up that subject in the books of Sigg, Schörcher, and others.

The same applies to the equally important office procedure for varicose ulcers, for which few suggestions for treatment are offered in

this book. One also misses descriptions of the surgical treatment of aneurysms of the aorta.

The chapters on the endocrine glands are good, dealing mainly with symptomatology and medical treatment. They are comprehensive and record the latest developments in endocrinology in a manner which is easy to stand.

Although published in 1960, there is no mention of oral hypoglycemic agents in the treatment of diabetes mellitus.

On the whole this book is to be recommended to the general practitioner in continental Europe.

KLINISCHE CHIRURGIE FUR DIE PRAXIS. In vier Banden. Band III, Lieferung 2. (Clinical Practice of Surgery. In four volumes. Vol. III, Part 2). Edited by O. Diebold, H. Junghanns and L. Zukschwerdt. 360 pp. Illust. George Thieme Verlag, Stuttgart, W. Germany. Intercontinental Medical Book Corporation, New York, 1960. $9.50.

This book deals with the stomach and duodenum, their anatomy, histology, vascular and nervous supplies, physiology, pathophysiology, diseases and surgery.

It seems, therefore, that the authors of this volume have advanced the art of editing surgical textbooks by trying to convey to readers under one cover as complete a picture as possible of the organ concerned. Furthermore, this book, originating from West Germany, stimulates interesting comparisons with daily medical practice in Canada.

An impressive number of British and North American authors are mentioned in this book. It appears that western Germany has adopted numerous medical items from the western hemisphere in the postwar years. For the sake of perfecting future editions, various shortcomings might well be pointed out here.

The frequent interpolation of bibliographical data into the text — nearly one to every line—interferes with the even flow of reading. An appendix would compensate for their omissions from the text.

In the chapter on peptic ulcer the authors have failed to enumerate proper mastication of food and dental care as important factors for the prevention and treatment of ulcers. Also, abuse of tobacco is only mentioned in passing. In the reviewer's opinion estrogen therapy for chronic peptic ulcer merits inclusion in the text.

The different indications for gastrectromy are crowded into a few lines and, to make things worse, references to other pages of the book are used. A better arrangement and spacing of the text would help the reader to retain this important matter in his mind. Finally, Virchow's gland should be mentioned among the findings leading to the diagnosis of cancer of the stomach.

(Continued on page 403)

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(Continued from page 401)

Apart from these few corrections this book offers the advantage of complete coverage of the subjects concerned in accord with the latest developments achieved in the medical world.

The chapters on "dumping syndrome", as well as the historical survey, listing milestones in gastrointestinal research over the last 300 years, deserve special praise and conclude this remarkable book.

PRINCIPLES OF ORTHOPÆDIC SURGERY. Paul C. Colonna, M.D., Emeritus Professor of Orthopædic Surgery, University of Pennsylvania Medical School. 799 pp. Illust. Revised edition. Little, Brown & Company, Boston.; J. P. Lippincott Company, Montreal, 1960. $22.00.

In this complete revision of his earlier work, Dr. Colonna has briefly covered the entire field of orthopedic surgery in adults and children on a regional basis. The opening chapters contain a summary of the physiology of bones and joints, a method of musculoskeletal examination and a section on general orthopedic pathology. Each region of the body is then discussed in a separate chapter pointing out the pertinent anatomy and special examination before discussing diseases and general anomalies, injuries to soft tissues and fractures as they apply to each particular region. The final chapters of the book deal with neuromuscular disorders, bone tumours and orthopedic appliances.

It is well indexed and although there are few if any references to works published within the last four or five years, most of the classic references have been included, making it a useful springboard for further background reading on any desired subject.

While any volume of this scope will contain sections with which the reader may disagree such as those on the surgery of cerebral palsy and tuberculosis, a very reasonable approach to the subject has been presented, obviously based on years of experience.

It should prove particularly valuable for residents in orthopedic training programs and will be a useful addition to the library of the general surgeon dealing with bone or joint problems as well as to the orthopedic surgeon.

ILLUSTRATING MEDICINE AND SURGERY. Margaret C. McLarty. 158 pp. Illust. E. & S. Livingstone Ltd., Edinburgh; The Macmillan Company of Canada Limited, Toronto, 1960. $6.35.

The text of this book, capably expressed and beautifully illustrated, is composed of well-known precepts and principles relative to medical illustration. It cannot be said to offer anything new. To the scientist or doctor with a flair for drawing it provides technical hints, suggests equipment and materials. The technical hints are neither simple nor full enough for the uninitiated and being scattered here and there are not easy to pin-point. The equipment and supplies suggested are well presented with names of dealers and prices but these are useful mainly to those living in the British Isles, many of them being obsolete by Canadian standards and not procurable on this side of the Atlantic. The value of the book lies in the comprehensive picture it gives of medical illustration, past and present. To art and science students at the undergraduate level and vocational guidance directors, it can be highly recommended.

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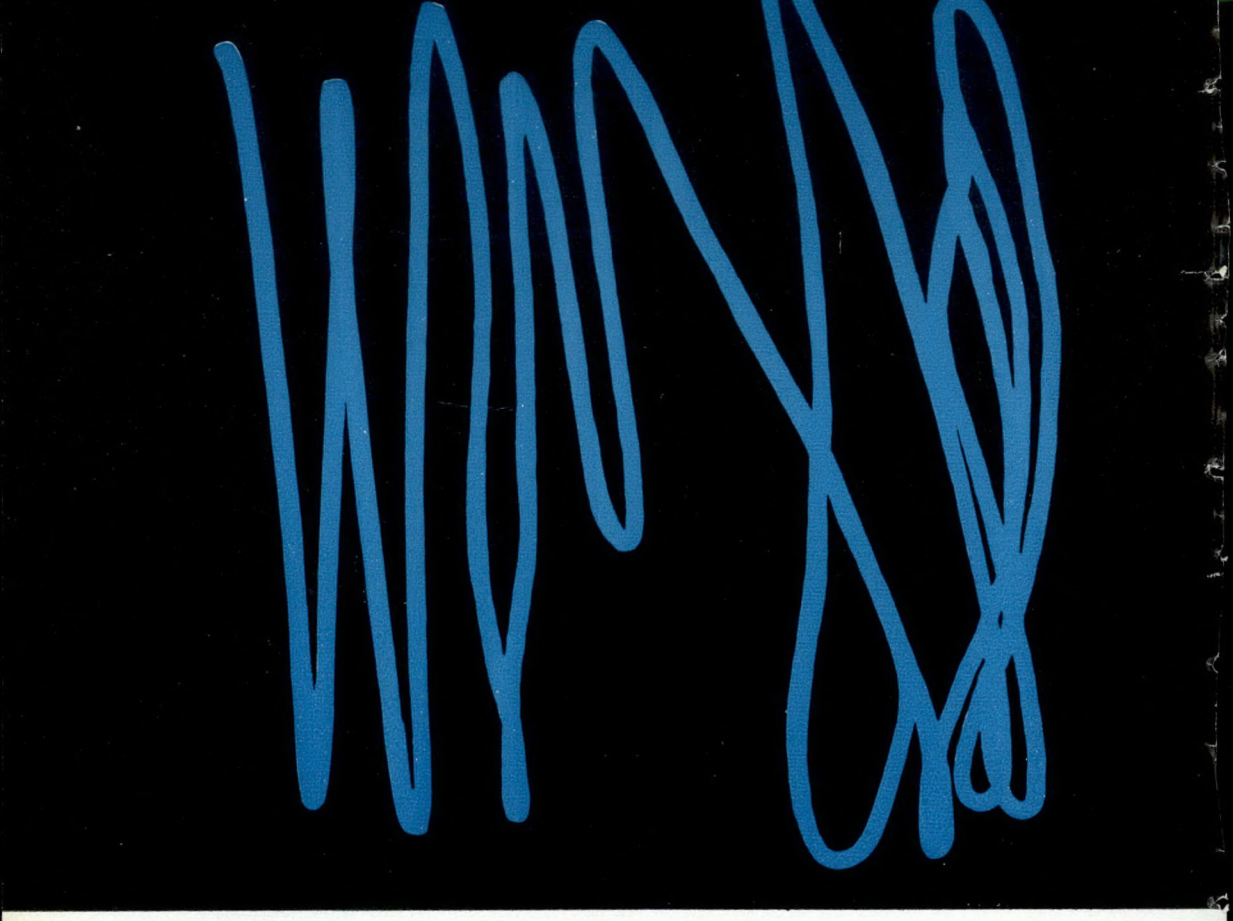
*"Scientific concepts enable certain aspects of the enormous complexity of the world to be handled by men's minds. They are suggested mostly by experiment but partly by mathematics, and controlled by the need that they should not lead to illogical consequences . . . Some are more fundamental than others, but even those which turn out to be only rough pictures of what really happens often retain their usefulness. They are sketches as compared with finished pictures, and if details are not needed a sketch is often clearer."

*Thomson, G.: The two aspects of Science, *Science*, October 14, 1960.



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